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Implications of financing models on infrastructure projects

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ABSTRACT

The global crisis of 2008 implied that many sectors needed a change. On the one hand, the civil engineering sector realized the urge for more sustainable and conscious practices. Due to its great influence in the general economy, while at the same time being the sector which more waste produces, is the key in switching towards global sustainability. On the other hand, the basics of the finance sector were also put at stake after the crisis. More specifically, in the current economic approach and regulations that were in need of alternatives.

In order to carry out this transition towards sustainability and change the way of working of sectors, the sustainable development goals (SDGs) were established. While the civil engineering sector has been applying different practices, the finance sector has recognized their value in either enhancing or hampering the investment in infrastructure projects that can create positive externalities for the environment. So, different financing models are coming to the scene as alternatives to the conventional financing of projects in the civil sector. This thesis is an explorative research of five financing models (micro finance, impact investment, land leasing, project financing and infrastructure project bond) and the implications that these have when applied to infrastructure projects. The work is divided in two main parts.

The initial part contains the first three chapters, and is meant to work as a preface including a general background and the changes that the civil engineering sector is currently undergoing (highlighting circular economy). Also, the finance practices that have been traditionally applied to the sector are explained, with public-private partnerships (PPPs) as reference.

The second part of the thesis addresses the five financing models along with its implementation in the civil sector. The different models are divided based on the environment to which they can be applied to: developing or developed countries. For developing countries, the models are micro finance, impact investment and land leasing. Whereas for developed countries environment, are project finance, infrastructure project bond and impact investment.

This study found out that regarding the developing countries environment, only the land leasing model is capable of financing infrastructure projects, but cannot be implemented as a fixed practice for a country due to the limited land availability. For the developed countries, both the project finance model (through the loan market) and infrastructure project bond (through the bond market) are able to finance this kind of projects. However, out of the three practices that could serve for financing infrastructures in the different environments, just the project finance model has currently established sustainable practices in order to create positive externalities when the infrastructure is build.

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LIST OF ACRONYMS

CE	Circular Economy
DFE	Design For the Environment
EIB	European Investment Bank
EIF	European Investment Fund
EU	European Union
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
GNI	Gross National Income
IFC	International Finance Corporation
KPIs	Key Performance Indicators
LCA	Life Cycle Assessment
LCE	Life Cycle Engineering
MDBs	Multilateral Development Banks
MDGs	Millennium Development Goals
MFBs	Microfinance Banks
MFIs	Microfinance Institutions
NABs	National Advisory Boards
PBI	Project Bond Initiative
PMSs	Performance Measurement System
PPP	Public Private Partnership
SBs	Smart Buildings
SDGs	Sustainable Development Goals
SIBs	Social Impact Bonds
SPVs	Special Purpose Vehicles
UN	United Nations

MOTIVATION, OBJECTIVES AND METHODOLOGY

The sustainable development goals (SDGs) have been established for some time now. Many sectors are changing their ways of working, also known as the sustainability transition. This applies as well to the construction sector and the finance sector. Furthermore, the global financial crisis of 2008 has been a turning point for both sectors. It highlighted the need for alternative economic approaches, more regulatory policies and an overall change in the procedure these sectors had been acting. With this background, both of these sectors are undergoing radical changes.

The construction sector is looking for active ways to absorb new technologies and innovations into their projects, like for example designing energy neutral assets, building houses of recycled materials or maintain roads with self-repairing organisms in the bitumen.

The finance sector is recognizing the game changing impact that these innovations have on sustainability and therefore, started to experiment with new ways of financing. This has consequences as the form of finance determines the behaviour of parties involved, given the associated financial expected returns and risk transfers. Particularly, the new financing forms that have been piloted and that are going to be considered in this study are:

- Microfinancing
- Land Leasing
- Impact investment
- Project financing
- Infrastructure project bond

The variety of forms in financing and their possible implications on either contributing or hampering the achievement of SDGs, calls for a better understanding of them. This project focuses on a state of the art review of these 'new' financing forms and their potential for the infrastructure sector. It aims to answer the following question: ***What is the current state of knowledge on the implications of financing forms on infrastructure projects?***

In order to break down the main research question, three different approaches are made:

1) *What are the similarities and differences between the various financing models?*
2) *To which degree are each financing models able to be applied in the civil infrastructure sector?*
3) *Which are the main conclusions disclosed from the cases that the different models have been applied to, and what is the potential relation with sustainable development?*

The methodology that this research is going to follow has an explorative research nature. Using sources from a systemic literature review approach, including both separate reviews of the academic literature (e.g. Google Scholar or Scopus) and non-academic (e.g. public outlets or web-based sources). There is significant amount of reports available on the different models, although they mainly remain as case examples. In order to obtain the necessary information, the method used consists on crossing keywords (i.e. sustainability, development, infrastructure project, circular economy, construction sector) with each financing model. Then, a reference management software is used (Mendeley), to organize the information in the chapters that the study consists on. After the initial thorough research is done, the data is complemented with specific articles depending on the information required (i.e. detailed examples or facts to support an idea).

Once all the required material is collected and in order to give answers to the set research approaches, the following strategy is going to be followed throughout the different chapters.

The first chapter of this research is designated to give a preface on the different topics that are going to be discussed throughout this study. So, concepts such as sustainable development goals (SDGs) or sustainable construction are developed. Also, it helps to enclose this study in a period of time, which marks the starting point of the research.

In chapter 2 a review of the most common financing practices up to date is described. On the one hand, the practices in developing countries and features of this environment are explained. On the other hand, current developed countries practices are clarified with the European Union as example. Also, general characteristics of infrastructures are highlighted.

In chapter 3 we have a description of the changes that the civil engineering sector is currently undergoing. These practices make reference to sustainable development aspects and the procedure of performance of the sector itself. Thus, three main current changes are described in the sector: life cycle engineering, energy transition and cycle economy.

Once this initial part is done, we move to the core analysis of this study. Chapter 4 gives a description of the five financing models considered in the research. Besides the main characteristics of each practice, also some differences between similar models are highlighted.

The fifth chapter is responsible for the implementation of the five models previously described. Based on the type of environment, developing or developed countries, each financing model is allocated on the environment that better fits due to its characteristics. Also, some policy recommendations for the implementation of the models in the corresponding environment is defined, along with case examples where the practices are found worldwide.

Finally, chapter 6 is divided in two parts. First, the consequent results from the implementation of each model is described. Then, the second part or final conclusion, is addressed to give answer to the three research approaches expressed as objectives of this study.

1. INTRODUCTION

1.1. Background: Global Financial Crisis of 2008

Financial crisis impact negatively on both developed and developing countries economy. Therefore, all kinds of sectors and industries collapse and many lead to bankruptcy. A perfect example of those industries is the construction sector. It is known that the construction industry contributes to gross domestic product (GDP) of almost all economies. That is why, a downturn in these activities affects a country's economy. Over the last decades there have been several global financial crises, but the most recent one (in 2008) has been considered of great severance. This crisis started with the subprime mortgage market and developed into an international banking crisis scale. However, we are going to focus on the effects that this global crisis had for the construction industry.

It is known that the construction sector is of a great influence for the economy. To have some perspective, in 2006 a U.S. Census Bureau report stated that the gross output by construction industry exceed 12%, being considered of a vast industry and larger employer [1]. The value of the different construction areas was also of importance: $269.3 billion for the public construction, $70.1 billion for the educational construction, $75.1 billion for the highway construction, $928.7 billion for the private construction, $630.3 billion for the residential construction and $298.4 billion for the non-residential [1]. So, a variance in the investment in the sector, either upward or downward, describes a possible boost or downturn in the

economy. That is why some researches have linked the growth of the construction industry to the GDP of most economies, considering it a valid indicator of a country's economy.

The figures 1.1 and 1.2 show the measure of the value added by the construction industry, and how it mimics the trends of downturn (for the U.S country, data from the Bureau of Economic Analysis).

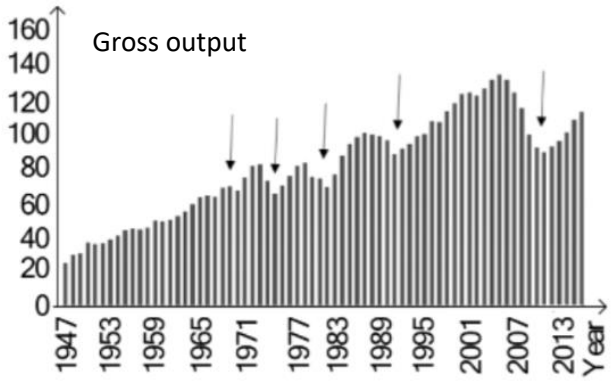

Figure 1.1 *- Gross output by construction industry between 1947 and 2016 [1]*

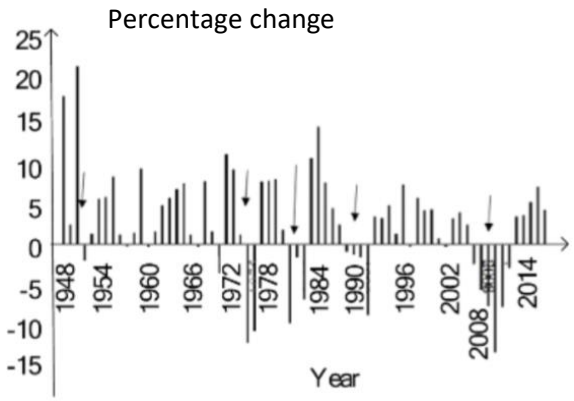

Figure 1.2 *- Percent change in chain-type quantity indexes for the gross output [1]*

We can see how there is a pattern where construction spending and related activities tend to peak at the commencement of any downturn. So, the construction industry appears to follow a cycle (in a kind of sinusoidal mode), where we find crest and troughs. A fluctuation of peaks shows up in a way that it appears just before the beginning, and more gradually starts again after the recession. Furthermore, we can say that right before the start of any economic crisis, with its corresponding downturn, the construction industry is adequately financed. According to this pattern, there are some variables that contribute to relate whether a recession could be coming: *construction spending, construction employment, new construction projects, supply and demand*.

- The first variable to consider is the *construction spending*, as the construction analysis of how high and low expenditures describe boosts or downturns. So, we expect a behaviour similar to the whole industry (a peak before the following recession).

- Another variable that we can encounter is the *construction employment*. During the rise of the sector in a cycle, there is a linked increase in the employment. Furthermore, when we have a decrease in the employment it implies a downturn. The construction itself can also be considered one variable to study when relating with a possible recession. Including the costs of land, labour and materials.

- We have to keep in mind that rising construction costs diminishes the demand on *new construction projects*, and so resulting in a collapse in spending and rise of unemployment.

- Last variable we can mention is the *supply and demand* in the lending markets. This is one of the best yet to come indicator, in markets where banks extend loans to one another on specific terms. Thus, when a decrease in lending happens it leads to a decline in the following construction aim.

Once we have defined some basis of the economic crisis, and how it affected the construction sector, we are now going to focus on the consequences that the crisis has occasioned. It is believed that the crisis from 2008 acted as a game changer, triggering many aspects of the society. So, game changers, when understood in these terms, help to orient, legitimize, guide, and accelerate deep changes in society [2]. Furthermore, when society faces a heavy recession as this last, debates are initiated around the flaws of the current financial system, and attention towards alternative economic tales are generated.

However, mainly all the political debates are concerned with relatively short-term economic issues, such as monetary losses, increasing unemployment, falling real estate prices, etc. [2]. This way of not addressing the root cause of the problem, is what makes economy to follow the cycle mentioned before (periods of peaks and recessions). So, a path dependent idea of optimizing existing institutional entities, is what will inevitably lead to recurring crises. That is why, there is a need for alternative economic approaches and fundamental changes is emphasized.

In this urge for profound developments in the basis of the economic and financial system, new narratives have come into scene like social economy, sharing economy, cooperative movement, green economy and so on [2]. However, many of these ideas are not by definition new. Indeed, many have been present for decades, but is the game changing economic crisis that has prompted renovated interest in these narratives.

1.2. Sustainable Development Goals (SDGs)

The developments in economy and finance mentioned before, are not the only ones that have been rising in the last years. Numerous advances in discussions on sustainable improvements have also been made. It is a fact that developed countries have experienced greater progress, but many developing countries have also realized the need to look for sustainability.

The World Commission on Environment and Development described the concept of sustainable development as ‘meeting the necessities of the present generation without harming the future’s generation capacity to meet their own’ [3]. Thus, the United Nations (UN)

plays an important role in constantly working to assist countries to overcome current and future sustainability challenges.

In this context, in 2001 the Millennium Development Goals (MDGs) were approved, by setting eight leads to make a world a better place to live by 2015. These goals were focused on hunger, education, poverty, health, gender equality and environment. However, due to globalization and the rise of complex challenges, in 2015 the Sustainable Development Goals (SDGs) were formed as a continuation of the MDGs.

The SDGs agreed by the United Nations in September 2015 comprise 17 goals and 169 targets, and is the core of the 2030 Agenda for Sustainable Development. This agenda is a plan adopted by the UN members and seeks global sustainability. Sustainable Development Goals aims to integrate matters related to sustainable development into the overall economic, social framework and environmental of countries [4]. Also, notice that the involvement is of not only national governments but also other stakeholders. That is why, it is considered a multi-stakeholder approach, with the combination of both private and public investment. Having diverse parties involved like academia, the regional and local government, private sector, international organizations, civil society, etc. to achieve SDGs.

Despite having a global dimension, the implementation of SDGs depends on the level of preference that countries decide to give them, and on how it relates with countries main problems. So, actions taken are mainly of local character, and depend on the will of fulfil from countries. In the table 1.1, it is shown the 17 goals that were set by the Agenda, all with a dimension on managing economy, on the environment and on society.

The 17 Sustainable Development Goals and their description.

1	No poverty	End poverty in all its forms everywhere
2	Zero hunger	End hunger achieve food security and improved nutrition and promote sustainable agriculture
3	Good health and well-being	Ensure healthy lives and promote well-being for all at all ages
4	Quality education	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
5	Gender equality	Achieve gender equality and empower all women and girls
6	Clean water and sanitation	Ensure availability and sustainable management of water and sanitation for all
7	Affordable and clean energy	Ensure access to affordable, reliable, sustainable and modern energy for all
8	Decent work and economic growth	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
9	Industry, Innovation and Infrastructure	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
10	Reduced inequalities	Reduce inequality within and among countries
11	Sustainable cities and communities	Make cities and human settlements inclusive, safe, resilient and sustainable
12	Responsible consumption and production	Ensure sustainable consumption and production patterns
13	Climate action	Take urgent action to combat climate change and its impacts
14	Life below water	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
15	Life on land	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, halt and reverse land degradation and halt biodiversity loss
16	Peace, justice and strong institutions	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
17	Partnerships for the goals	Strengthen the means of implementation and revitalize the global partnership for sustainable development

***Table 1.1** - The 17 Sustainable Development Goals and their description* [5]

These set of 17 goals shown above are thought as the most remarkable points for understanding and achieving environmental and human development ambitions, by the year

2030. In order to fulfil them, research, innovation and sustainable education are key factors. As we can see from *Table 1.1.,* each one of the 17 goals focus on a specific area: from health-related issues (hunger, clean water, poverty…) to other more social (gender equality, decent work, peace and justice…).

For this thesis, the goals that interest us most are the ones relevant to sustainability, and more specifically in the construction sector. Thus, the main goal that summarizes these ideas is number 11, *Sustainable cities and communities,* focusing on making cities inclusive, safe, resilient and sustainable. However, other goals can be added to the principal, such as goals 9 (*Industry, innovation and infrastructure)* and 12 (*Responsible consumption and production).* Even though these do not specify the construction sector, have as aim to promote sustainability in industrialization processes, while ensuring awareness on consumption and production.

As the SDGs have been running for some years (keeping in mind the previous MDGs also) there have been studies related to measurement, monitoring the progress and evaluating the performance of goals on different regions. Nevertheless, few research has been done on the actual extent that the Sustainable Development Goals are being reached worldwide. That is why the recent research conducted by *Salvia et al. (2019)* is of profound interest. They conducted a survey on the SDGs, as they gathered information from experts around the world (professors, researches, private sector, students and NGO representative). They mainly focused on the verification of research trends by analysing the SDGs that each expert pointed out.

Regarding the interest in the SDGs 9, 11, 12; *Salvia et al. (2019)* found out which is the percentage of experts choosing the corresponding areas as their research, gathered in *Table 1.2* [6].

Geographic region	SDG 9	SDG 11	SDG 12
North America	8%	35%	22%
Latin America - Caribbean	21%	50%	29%
Africa	5%	20%	13%
Asia	9%	25%	19%
Europe	24%	38%	39%
Oceania	17%	50%	33%

***Table 1.2** - Percentage of experts choosing as their research area one of these SDGs*

The information above show the trends that experts are following worldwide. We can see how SDG 11 from the others also related with sustainability, is indeed the construction sector the one with higher percentage in every region, except Europe where SDG 12 is higher. It offers

useful insights into how the SDGs are perceived, but most importantly reaffirm the interest for sustainable development in the construction sector.

Thus, until now we have covered what are the SDGs and to what extent they are being considered. That is why we should now move more to the construction sector itself, and more importantly to how does it link with the sustainable development.

1.3. Sustainable Construction (SC)

As we have mentioned before, the concept of sustainable development could have a wide range of interpretations due to the local level of implementation, and the fact that countries dictate whether if it is in its interest to invest or not in a sustainable project. That is why SDGs also were brought up, to specify the basis on the concept of sustainability.

Moving now to the construction sector, despite being defined as one of the goals (11), an attainment for the concept of sustainability in the construction industry has to be made. Construction is considered to be the cause of many environmental problems, from excessive consumption of global resources to the pollution of the surrounding environment. According to the journal *World Watch,* one-tenth of the global economy is dedicated to constructing, operating and equipping homes and offices. Accounting for almost 40% of the materials flow entering the world, it is then noticed that the impacts of the construction industry to the environment are extensive [7].

Also, the building sector is noticed for its extensive consumption, and generation of negative externalities to the environment. To get some notion of the volume of waste that the construction sector generates, in the EU accounts for approximately 2.5 billion tons per year [8]. As shown in the figure below (*fig 1.3*), the waste generated in 2014 is decomposed by sectors. Notice how the construction sector accounts for the 35% of this total waste, being the sector with highest production, followed by the mining and quarrying one.

In this context, the construction sector has the responsibility of moving towards more sustainable practices. However, the term of *sustainable construction* opens some debate. At first it was defined as the proposal to describe the responsibility of the construction sector in reaching sustainability. However, considering that the International Union for the Conservation of Nature and Natural Resources (IUCN), described in 1991 a sustainable activity as one which can continue forever [9]; a construction project cannot be considered inside that category.

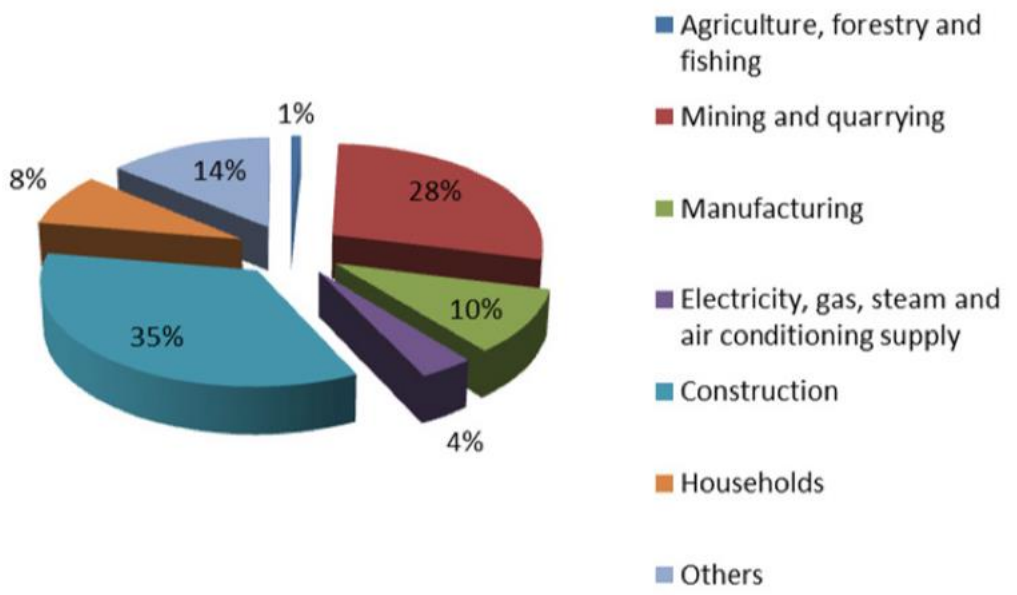

***Figure 1.3** - Waste generation in the EU by sectors in 2014 [8]*

So, generally the term for sustainable construction is used to describe the process that starts at a previous phase of the construction itself, with the design stage, and does not end with the finalization of the construction. In the seek for finding a common ground between the general concept of sustainability and the particularities of the sustainable construction, four attributes stand out: *social, economic, technical* and *biophysical principle*. These, are considered to support and underline the fulfilment of sustainability. Thus, they are known as the pillars of sustainable construction [7]. The implementation of these principles, would make the construction industry more sustainable. Next, the different principles and its effectively are discussed.

- The *social principle* of sustainable construction is based on the idea of social justice, and more specifically in addressing poverty and inequity. Thus, it calls for improvement in the quality of human life, but also protecting and promoting human health through a healthy and safe working environment. In the development planning, there has to be ensured that the construction is suitable with local technologies and institutions. Furthermore, while the construction takes place, reducing the risks of accident and managing substances that can hazard human lives is also considered. Additionally, in the aim of looking for future generations, an intergenerational equity has to be a goal to achieve so that costs of current constructions are not passed on to next generations. Finally, a seek for equitable distribution of both the socials costs and benefits of the construction. When not achieved, an optimization or a compensation of these, that may have originated during the construction process.

- Regarding the *economic principle* for sustainability in the construction industry, the first aspect that needs consideration is to ensure financial affordability for intended

beneficiaries. This means promoting the acquisition by setting minimums in the housing and associated services standards. Employment creation has to also be promoted, likewise in some cases labour intensive construction too. When talking about prices and tariffs, in order to achieve a more equitable development and efficiency in the use of resources, a full-cost accounting and real-cost pricing is going to be used. Also, by enhancing competitiveness in the market place along with a choice in environmentally responsibility, there is an advance on issues of sustainability. Last, practitioners seek maintain to meet the needs of future generations by investing proceeds from utilization of non-renewable resources in human-made and social capital.

- The third principle in discussion is the ***biophysical principle*** of sustainable construction. Proposed by the IUCN, is this is based on the requirement that sustainability urges an improvement of the quality of human life within the carrying capacity of supporting ecosystems. It has to be noticed that the term biophysical is used to include the atmosphere, land, underground resources, marine environment, fauna and flora, and the built environment. First, by extracting fossil fuels and minerals while producing persistent substances foreign to nature, at rates which are not faster than their slow redeposit into the Earth's crust. With respect to the resources, the need for reducing the four most used in construction: water, energy, materials and land; while trying to maximize the resource reuse and recycling. Other recommendations like the use of renewable resources over non-renewable, or the creation of a healthy and non-toxic environment. Closing, the minimization of air, land, and water pollution at both local and global scale; and of damage to sensitive landscapes (like cultural, historical, and architectural).

- Moving to the fourth and last pillar, the ***technical sustainability*** principle relates the performance and quality of a structure. However, covers also the requirement of humanizing larger buildings, but focusing on the technology necessary to achieve the outcome rather than the social concern of it. For this principle, specialists seek to construct durable, functional and reliable structures. There is also a pursue to quality in creating the built environment, while using serviceability to promote sustainable construction. Regarding to the existing urban infrastructures, an infill and revitalization with a focus on rebuilding mixed-use pedestrian neighbourhoods. More socially speaking, there is also a search for humanization of larger buildings.

However, the optimization of the four principles is not always feasible. That is why, there are different approaches on how the emphasis to each one of the four pillars has to be made. This choice of which principle to apply for a specific construction project, depends on the grade of severity on which sustainability wants to be implemented. For each project thus, the importance of the principles will vary, but always with endeavour for an agreement between

parties involved. Notice also that these principles are limited to recommendations for the practitioners on subjects of process. So, no quantitative examples are provided to determine if an action fits or not the sustainable basis for a principle [7]. This due to the fact that stakeholders involved in a project should use the listed pillars, and their recommendations, as a check list. Again, the decision on which should be applied and the extent of its applications is on the hands of the parties.

Relying on the design of a project to fulfil a SDG, or to minimise impacts through appropriate management on site, is not enough to satisfy the current sustainable problem [6]. The goal for sustainability is set on a previous stage than the design phase of a project, before any commitment is made to start with a development. Furthermore, the selection of environmentally friendly designs during the stage when environmental aspects are incorporated, is called appraisal stage. There are many environmental building assessment methods used in different countries. Using a single method to asses a building's environmental attainment while satisfying all requisites from users is no facile task. That is why an ideal environmental building assessment will cover different requirements of the stakeholders implicated in the development. First, an environmental building assessment method shows the importance of the concept of sustainability, in terms of building design and consequent construction on site. Second, they contribute greatly to the understanding of the relationship between building and environment [6].

Some environmental building performance assessment methods have an international application like the Green Building Tool (GBTool). This has been extended to contain areas that have been ignored or not well defined in existing environmental building assessment methods for valuing building throughout the world. Some characteristics that arise from this method are that is the most comprehensive framework, with international collaboration of over 20 countries. More importantly, the GBTool has a comprehensive evaluation method that can be used by different regions with the adaptation of local or regional variations. Also, with absolute performance indicators that allow the complementation of relative scores.

More locally, the Eco-Quantum assessment method stands out. It has its origins in the Netherlands, and it is the only method that is precisely and clearly based on life-cycle assessment. This method features an easy application and counts with an extensive database of the most ordinary used materials and products. However, it distinguishes from the GBTool because it does not have a comprehensive assessment method, and it is only applicable to single residential buildings.

2. HISTORY OF FINANCING CIVIL ENGINEERING PROJECTS

2.1. Introduction

Usually the concept of investment is related with the flow and the idea of capital with the stock. Thus, the investment is the expense's flow allocated to maintain or increase the stock of fixed capital. That is why, the investment can be seen as the gross fixed capital formation (GFCF) [10]. It is a macroeconomic concept used in diverse national accounts, that measures the value of acquisitions of new or current fixed assets by governments and the business sector [11]. The aim for creation and improvement of capital from an economy can be obtained with the rate of inversion, as the relation between GFCF and the Gross Domestic Product GDP.

On the other hand, we understand infrastructures as the unit of assets that support the productive frame and ease the trade of goods and services, individual and group consumption, and social activity [9]. The influence of infrastructures in an economy's production has two main features. First, infrastructures have a direct effect on the productivity as they are considered a variable of it. But second, infrastructures also affect indirectly to two the other aspects of productivity: the work and the business capital.

Infrastructures are distinguished between economic infrastructures (transport, utilities, communication, renewable energy…) and social infrastructures (education facilities, healthcare facilities, judicial buildings…). They are characterized for being able to accomplish with the economic and social activity during long periods, while generating external economies. That is why infrastructures are of so interest to the public sector, as they comprehend both social and economic agents in terms of effectiveness of the production, distribution, consume of goods and life quality.

Once we have discussed the idea of infrastructure, there are *four effects* that the development of infrastructures has on a country's economy [9]: *arrangement effect, positive externalities, aggregated demand* and *cross generational effect.*

- First, the *arrangement effect* on a territory, as there is a direct relation between the location of infrastructures and the location of production activities. So, thriving regions produce a high demand of infrastructures, while at the same time these last promote the development of the region, creating a cycle. However, less developed regions (as they have fewer infrastructure equipment) they are a not attractive enough to invest in, creating again a cycle. The public sector is a key factor in balancing this territorial situation, by using infrastructures as revitaliser of deprived regions.

- Another outcome from the development of infrastructures are the *positive externalities* upon competitiveness. Due to the higher degree of interrelation between the different production activities, one main product's cost depends on the progress of the infrastructure. Also, other activities like the education system with its contribution to the human capital are important for the competitiveness of an economy.

- The third effect is around the *aggregated demand*. Keynes stated that the inclusion of a state in economic policies with the aim of maintaining the rise in a system, has to be done through aggregated demand [9]. When unemployment occurs, by increasing the public investment we stimulate the aggregated demand, generating an escalation in supply, work and so in the final demand. Thus, an active infrastructure development strategy acts as a multiplier in generating positive outcomes for undeveloped economies.

- The last consequence that the development of infrastructures has on economy is the *cross generational effect* when financing infrastructures. The encumbrance of the public sector to finance infrastructures has an influence over future

contributors that will assume the costs of the debt. However, this effect does not have to be negative. This would happen if future generations receive proper capital to improve the productivity of the economic system and the quality of life.

2.2. European Union

The enrolment of the European Union in matters of infrastructure started with the 1972 Summit in Paris. Even though the infrastructure's competence were still exclusively a state's issue, some first recommendations were brought up. These proposals aimed that future infrastructures not only satisfied the country's necessities, but also community needs [12]. However, due to absence of support from the European Union, the development related to community infrastructures was almost null.

With the approval of the Treaty on European Union in 1992 the EU introduced a XII topic that makes reference to the trans-European network. The goals and ways to procedure were set in terms of transport, telecommunications and energy infrastructures. One of the main purposes was that the Community was going to be involved in the establishment and development of the network. This is done in order to facilitate the free exchange of goods, people, capital and services. Also, it supports the social and economic connection, and allows citizens and states of the EU to take part in the benefits resulting of a non-border area. Thus, the aim of the EU is to assist the inter-connexion of national infrastructure channels, and the access to these, while establishing links in-between all regions.

In order to meet with all these requirements, during the 1992's Treaty the economic contribution through the Cohesion Fund was established. It is aimed at Member States whose gross national income (GNI) per inhabitant is less than 90% of the EU average [13]. The main aim of this Fund is to reduce social and economic inequalities and to promote sustainable development. The requisites to obtain support from it, are that the project has to have an international interest and scope, as defined in the Treaty. The forms of financial help are the following [9] :

a) By *co-financing reports* related with the project, including preparatory reports, evaluation and feasibility reports, and other technical reports. However, as a common rule the financial participation of the Community will not exceed the 50% of the total report's cost.

b) Through *interest bonus* on the loans issued by the European Investment Bank or other public financial entities. Generally, the duration of the bonus will not be higher than five years.

c) Contributing in the *credit premiums insurances* from the European Investment Fund (EIF) or other public financial entities.

d) In specific occasions, the contribution is made over *direct investment granting*.

e) By being participle in the *venture capital* for investment funds with the main goals of easing the capital risk for projects where the private venture is important. The action will not surpass 1% of the expected budgetary mean.

f) *Combining supports* in cases a) and e) by the Community, with the idea of maximizing the outcome of the financial resources already provided. This mixture has to be used in the most profitable situation.

Notice that when defining the criteria for the selection of projects, it is established that aid will be granted to projects on the basis of their contribution to the achievement of the objectives, established in the area of trans-European networks in the Treaty on European Union. Projects must have a potential economic viability and financial profitability, considered insufficient at the time of the request. Some other aspects will also be taken into consideration, like the maturity of the project or the stimulus effect that the community intervention will exercise on public and private financing. Last, additional features like the direct and indirect socio-economic effects and the environmental consequences.

After the Treaty in 1992, and with the idea of setting of trans-European networks, partnerships between the public and private sectors arise. The Community endorsing these recommendations, encouraged the formation of Public-Private Partnerships (PPP) inviting member states, the Commission, the European Investment Bank (EIB) and the Fund European Investment Fund (EIF) to participate in this project.

2.3. Public-Private Partnerships (PPP)

PPPs are the long-term arrangement relationships formed between public sectors and private entities, aiming to procedure and provide public assets and relevant services through the use of private sector's resources and expertise [14].

The purpose of the PPP constitution is to enable the development of projects that may be highly recommended from an economic or social point of view, but that are not

sufficiently attractive for private initiative. The benefits that are expected from these associations go beyond the mere collection of private funds for infrastructure financing. What is intended is to break the traditional antagonism between the public and private sectors, so that the objectives pursued by each of them are reconciled. That is, socio-economic profitability on the one hand and financial profitability on the other. Although the participation of private financing makes it more expensive to carry out a project, the advantages derived from the greater efficiency of the private sector, and the progress that can be achieved in the commissioning of the new infrastructure, can overcome the increase in costs.

Governments adopted PPPs as they offer different benefits, such as: *accelerate infrastructure provision*. *timely project implantation, reduced whole life cost, reduced government risk exposure* and *management of public expenditure*

- First of all, these relationships *accelerate infrastructure* provision as it allows the public sector to translate capital expenditure into an income (flow of on-going service payments).
- Also, PPPs grant *timely project implantation*. This occurs through the allocation of design and construction responsibility to private sector.
- The third advantage of this contractual relationship is the *reduced whole life cost* and motivated performance.
- It is offered by the solid incentives of private sector to minimise cost and improve management over project's life cycle. In addition, PPPs benefit from *reduced government risk exposure*, as it transfers such risk to private sector. Other interest for governments is the improved service quality and innovation through the use of private sector expertise and performance incentives.
- Last, PPPs enhance prudent *management of public expenditure* and reduced corruption by the increase in accountability and transparency [15].

One of the premises to fulfil for the good performing of the PPP is that both private and public participation assume the risks over which it has greater control. While the private company assumes the commercial risks, the public administration takes charge of those risks over which it has a more direct control. These risks are, for example: changes in legislation, delays in the processing of administrative files, etc. The public sector will make contributions to the project in the form of investment subsidies or tolls to be collected, refundable advances, guarantees of use, transfer of land, etc. These will allow

private companies to achieve sufficiently attractive rates of profitability to participate in the project, without the user having to bear excessive loads. Nevertheless, the public sector will recover its contribution not only through the possible social benefits, but also considering the *collection of taxes* and the *income derived from the rents*. Notice that the implementation of the project can entail direct increase in the collection of taxes. But also, thanks to the multiplier effect that originates the construction of the new infrastructure, there will be more income derived from the rents. Thus, the state may recover its contributions in relatively short periods.

Regarding the evaluation of PPPs, the process is designed for examining and reporting the effectiveness and efficiency of the actions taken towards defined objectives and organizations. As infrastructure PPPs are considered construction projects in nature, the performance measurements are focus on three levels: *industry, corporate* and *project.* The emphasis is being placed on key performance indicators (KPIs) and performance measurement systems (PMSs). In theory, KPIs are measures in which performance of associated process are indicated, while PMSs are structures where strategic, tactical and operational actions are linked to process to provide information needed to improve the service. Infrastructure PPPs are undertaken by Special Purpose Vehicles (SPVs). These, are the consortiums accountable for designing, building, financing, operating and maintaining public resources over a period. SPVs operate in the context where goals and objectives at project levels must be accomplished. That is why the framework adopted for assessing PPPs should cover issues at both corporate and project levels [16].

However, public private partnerships approaches have inclined to focus on meeting the budget, schedule and project duration objectives. These single dimension assessments may not consider the complex legal, organisational and financial interfaces created by multiple stakeholder interactions. That is why other practical variants of PPPs in the development of infrastructure projects have set up. Some models are: build-operate-transfer (BOT), build-own-operate (BOO), design-build-finance-operate (DBFO), lease-develop-operate (LDO).

2.4. Developing countries

As mentioned before, accessibility to infrastructures plays an important role in the economic development of any country. Infrastructures are noticeable impact of growth and expansion of a country, in addition of improving the quality of life of the people. Due to the population growth and arising of globalisation, there has been an urgent need of large infrastructure in all developing countries [17]. However, in many of these countries the need for services exceed the existing financial resources. Plus, other

resources (equipment, materials, etc.) necessary for the construction of decent infrastructures have to brought from industrialised countries, at huge cost. The high levels of debt in most developing countries imply that need for new methods of financing infrastructure projects. That is so, that up to 132 developing countries, about 2500 projects conceived private sector participation, attracting investment commitments of US $750 billion during the years 1990-2001 [16].

Before getting into detail with different methods and founding sources for developing countries, we have to define what we mean by that. Countries are classified for analytical means according to their economies, and gross national income (GNP) is usually the main criterion to do so. The classification is as follows: [18]

a) *Low-income economies*, those with a GNI per capita of US $995 or less in 2017.

b) *Lower middle-income economies*, with a GNI per capita between US $996 and US $3,895; and upper middle-income with a GNI per capita between US $3,896 and US $12,055.

c) *High-income economies*, are those with a GNP per capita greater than US $12,056 in 2017.

So, both low-income and middle-income economies are considered to as developing countries. Notice that this classification by income does not necessarily reflect development status. The term ‘developing countries’ refer to ‘developing economies’, i.e. countries with low or mid income [19].

Moving now to the traditional methods that developing countries have been using to finance infrastructure projects, *provision* has been commonly used by the public sector. Funds for the development on infrastructures are conventionally obtained from general taxation. However, low levels of public finance resulting from this taxation, made governments rely on borrowing from bilateral and multilateral development agencies in order to finance projects. Due to great debt burden, while countries used to borrow to invest in infrastructures, a large proportion of the amount borrowed is now used to service debts. Thus, over the years the level of financial availability for borrowing has been reduced.

Funding sources for developing countries need an enormous transfer of resources from wealthier countries, in order to be able to implement their capital infrastructure projects. The traditional way of directly transferring capital by means of grants and loans, changed to transfers through Foreign direct investment (FDI). This change was

encouraged partly due to the high debt levels, and partly by the change in political dispensation in the finals of last century. The aid of funding sources for developing countries takes several forms: outright grants, loans and assistance in kind and technical aid. Regarding the flow of resources, it may be in the form of government aid or private investment. Government or official aid turns into, as mentioned before, *bilatera*l and *multilateral aid*.

- First one, ***bilateral aid*** is finance provided by a foreign government to assist in funding the beneficiary country's projects. It results in capital flow from donor government in industrialised countries to developing countries. This aid has two main objectives, to provide bilateral capital flow and gaining political influences, and to aims like fighting poverty or environmental protection. Most developed countries have their own government bilateral aids agencies, that fund projects in developing countries through loans and grants, and direct aid to those developed banks of which they are members. Some examples are the UK's Department for international development (DfID), or the Netherlands finance company for developing countries (FMO).

- On the contrary, ***multilateral aid*** is a major source of official finance for infrastructure programmes. It is supplied through Multilateral development banks (MDBs), that include major banks like the World Bank Group, the Asian Development Bank (ADB), the African Development Bank (AfDB) and the Inter-American Development Bank. Drawing their funds from different countries, they operate as commercial banks' (lending money at certain interest rate) but with loan conditions more favourable, such as allowing periods of grace before repayment starts. Notice that the actual size of MDBs does not reflect their overall importance. This is due to the fact that they act as financial catalyst. So, the World Bank finances about one-third of the capital costs of its projects, but its influence is on three times the total amount of disbursement [18].

At the beginning of this chapter is stated that both public financing and management of infrastructures have failed to balance with the rising demand. Differently, the private sector has traditionally only been participle in a passive way. During the implementation phase, participating as consultant and contractors of infrastructure development that still was financed and managed by public sector. In the search for alternative methods, some countries have asked for a more actively participation of private investment and managing. Still, this participation is only feasible and sustainable when both private and public interests are met, while compliant with quality infrastructure services at competitive price [18].

3. CURRENT CHANGES IN THE CIVIL ENGINEERING SECTOR

3.1. Introduction

The civil engineering sector is characterized for its static behaviour when it comes to change. However, the global financial crisis of 2008 marked an inflection point in the linearity of the sector. Not only the need for more regulatory and strict policies regarding the granting of projects was then identified, but also the idea of a more conscious and responsible sector.

It is true that also as a result of the crisis that suffered the sector, the transformation towards a more modern sector, with the inclusion of new technologies has emerged. Some changes that are already apparent today are the different construction software. These are led by technologies such as Building Infrastructure Model (BIM), that aim to improve the communication between parties involved in the different construction phases, in order to be more efficient.

However, the ultimate goal is the establishment of sustainable building method in the construction procedure. In this context, this chapter gives an overview of the different practices that are already being implemented, towards the development of a more sustainable sector. Also, gives a notion on how not only the civil engineering sector itself is able to make an impact, but how the financing sector acts as moderator in granting sustainable projects.

3.2. Life Cycle Engineering (LCE)

Traditionally, the construction industry has been focused on meeting the technical and economic performances of a project. However, these classic approaches are no longer enough for the society and market needs. With the arise for environmental friendly projects, strategies and development methods to promote construction products, must nowadays incorporate ecological aspects in the construction design.

In this context, life cycle engineering (LCE) emerged to answer the needs for development in life cycles, causing the lowest possible environmental damage while still complying with economic viability. Thus, LCE include the application of technological and scientific principles for designing constructions, with the aim of protecting the environment and keeping resources. At the same time, it seeks to encourage economic progress, while optimizing the project life cycle and minimizing the pollution and waste [6]. In other words, LCE is a decision-making methodology that considers performance, environmental and cost requirements for the duration of a project [20]. It has a really important approach, as decisions made in early stages of the design process, can have greater impacts on life cycle parameters like time, cost and quality.

Furthermore, a key element of life cycle engineering is design for the environment (DFE), which main goals are to efficiently manage renewable sources, reduce the use of non-renewable, and minimize the hazardous release into the environment. To achieve them, some principles can be applied: prevention, functionally thinking, chain management, life-cycle thinking and paradigm shifts [20]. Even though environmental issues are approached at each phase of the product's life-cycle, the earlier it is implemented in the design stage, more effectiveness and less cost impact would have. One of the principal points of DFE is life-cycle assessment (LCA), a tool that visualizes the environmental and resource consequence of the choices that LCE deals with (about product concept, materials, structure and processes) [20]. Thus, all features of the product's life-cycle are considered as a whole when assessing. Both conceptual and technical framework are needed to classify LCA, since it evaluates the environmental accomplishment of an activity over the entire life-cycle. However, this procedure is expensive and time costly, plus the significant investment necessary in measurement equipment.

3.3. Energy Transition

The problems regarding the existing energy systems are commonly known. There is a general focus on the negative impacts for environment when using fossil fuels. Many studies sum up that renewable energies have the capacity to take the leading role in the world's energy system. However, nowadays the debate around sustainable energy systems is confusing. According to *Wang et al. (2017),* there is a mix with short term considerations (around energy

prices) and long-term considerations (about environmental impacts, primarily climate change). It is a fact that fossils fuels will continue to be dominant for a long time [21]. A practical solution could be to use less fossil fuels every year, so that the related impacts are reduced. Then, there is a need to include more extensive analysis on '*short-, medium, and long-term potential and consequences of using different primary energy sources, energy carriers and energy transformation technologies*' [22]. The main challenges that today's energy systems are facing, are mainly related to the generation of energy (from primary sources) while supporting the economic growth and distribution of wealth. These, should be done in order not to threaten ecosystem services or human health [22].

In this context, the understanding of diverse mechanisms and policies towards more sustainable ways of energy generation and utilization have been increasing, what is known as transition studies (TS). One main topic of TS is the change to sustainable energy deployment and utilization: energy transition [23]. This long-term structural shift focuses in increasing energy efficiency, and replacing conventional energy sources (oil, natural gas…) with decentralized renewables (wind, solar power, geothermal…) [24]. Furthermore, the construction sector, and in particular the building one, plays an important role in this transition to more a more renewable energy system. Notice that one-third of the global final energy is consumed in buildings [25]. In order to increase energy-efficiency in this sector, there is a wide adoption of green building or sustainable building. It focuses on innovative building designs, efficient materials and technologies; for example, insulation, solar hot water systems or integration of renewable energy. Besides these, outlines in supporting policies and new forms of business practices and services are also necessary to impulse the sustainability transitions in the building sector [26].

As a result, new designs and construction concepts have been emerging lately, such as low-energy buildings or passive houses. One idea that summarizes these different innovative techniques are smart buildings (SB). This concept proposes a multi-source, -load and -storage system, all arranged by information and communication technologies. The SB can be seen as an energy micro-grid connecting wind turbines, solar panels, fuel cells, energy storage capabilities, etc. All of them connected to a software that uses information like energy price, weather forecast and other external and internal constraints [27]. These programs have basically the general idea of transforming buildings into a potential production of renewable energy.

So, once these current changes (Life-cycle engineering and Energy transition) for sustainability regarding the construction sector have been described, as this thesis has an approach to both civil engineering and finance sectors, we are going to see now how to address this topic into an economic play.

3.4. Circular Economy (CE)

The concept of Circular Economy has been developing for the last two decades. It started by defining how natural resources have an influence on the economy; afterwards it added a focus on industrial economic, with a loop economy to describe industrial strategies. Later definitions include various concepts that share the idea of restorative. A global description defines a regenerative system in which resource input, waste, emission and energy leakage are minimised by slowing and closing material an energy loops [28]. In a circular economy (CE), waste and resource are minimized, and when a product ends its useful life, it is used to create further value. This way, value of products and materials is preserved as long as possible.

In order to get some idea on how the final concept of CE looks like, the following figure (*fig 4*) illustrates the key steps that a product or project needs to allow for turning into a circular model.

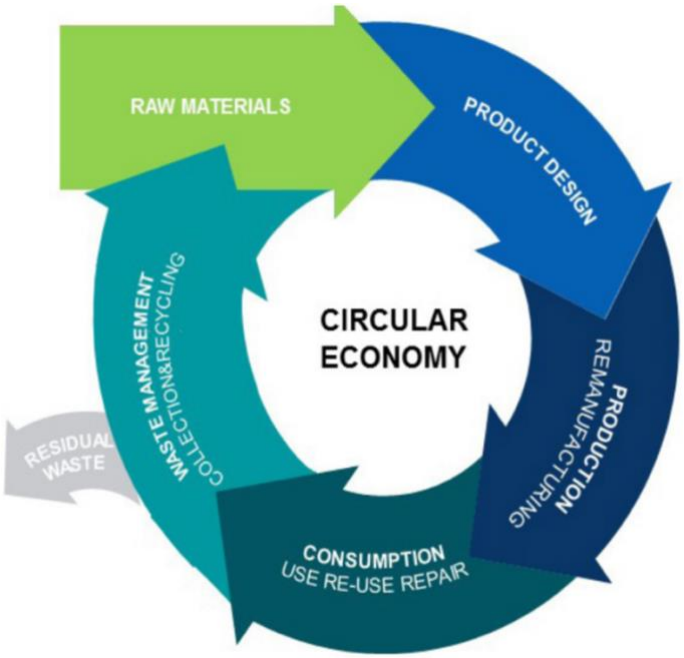

Figure 3.1 - *Diagram on key steps for a circular economy model* [29]

According to a policy report by *the Smart Prosperity Institute* (2018) [29], the concepts behind the core strategy for implementing circularity are:

- *Product design*, with the idea to last longer and more durable, using sustainable materials that can be easily recycled at the end-of-life.
- *Production*, collaboration and coordination across business of the sector to reduce the waste produced, along with greenhouse gases and fossil fuel consumption.
- *Consumption*, it differentiates between consumers (actions like sharing assets or

repairing them for re-use) and producers (recovering materials from the production throughout its lifecycle).

- *Waste management*, improve a cost-efficient collection and treatment systems, so fewer materials end up without a next use.

The other stakeholder that plays a key role in accelerating the transition towards a CE are financiers. They are able to facilitate finance for projects that comply this sustainable business model. In this context, a group formed by three important banks (ABN AMRO, ING and Rabobank) aimed to create and stimulate a common comprehension of CE finance. They established the CE Finance Guidelines as an approach for debt and equity issuance towards circular companies (those in the CE) and circular projects (those that back up the transition to a CE [30]. These guidelines have four main components: *Use of Investments, Project Evaluation and Selection, Management of Investments* and *Reporting*

1. The first guideline approved is regarding the *Use of Investments*. The utilisation of the investments for CE is the foundation of debt and equity finance. So, to evaluate whether a company or project adds to CE, three elements are assessed:

    a) *Business model assessment*: includes socio-economic and environmental impacts in the circular assessment of the company or project. Some business models that generate long-term positive impact are considered, such as circular inputs (when companies/projects substitute virgin raw materials with recycled materials from recovered resources). Another model is the sharing business, through which companies/projects increase the volume utilisation of an asset during its life, while optimizing the exploitation of the asset. Similar model is life time extension, that by remanufacturing extend the useful life of products or assets. Last example of business model is circular facilitator. Creating networks and collaborations between facilitators in the CE (consultancy, engineering, knowledge and data providers) enable an easier shift to a CE.

    b) *Impact assessment*: a qualitative and quantitative evaluation of the environmental impacts of the company/project, using for example the LCA method (explained before). The focus is on material, energy and water use, but also pollutant emissions or general waste generation. The social aspect is also applied in this assessment, the importance of working conditions, human rights, gender equality or health are covered in a CE.

    c) *Exclusions and conditions*: projects that monetise by products of fossil fuels or that do not have full effort to divert recyclable materials are excluded. Also, to not classify renewable energies straight into CE projects, although the use of them is

a vital component of a CE. As a condition, these guidelines mention that resource efficiency measures, are only considered circular whenever they incorporated closure and loop of resources.

2. Process for ***Project Evaluation and Selection*** is also a core element of the CE Financial Guidelines. Communication between financiers and stakeholders per project or portfolio has to be made, so that the issuer knows how financial products fit within the eligible CE business models just mentioned. Also, the eligible criteria regarding exclusions and risk applied should be acknowledged. Last, financiers should communicate the environmental impacts and social sustainability objectives that the project/portfolio includes.

3. Next main component is the ***Management of Investments***, where the recommendation is about verification that the initial investment continues in the line established. So, the investment is tracked in the accounts of the receiver, so that during the lending period still contributes towards a CE.

4. To conclude with the guideless set by the working group of banks, the constituent of ***Reporting*** is also important. Performance indicators, both qualitative and quantitative, are recommended to make the information available, regarding on the debt and equity activities that support the transition on a CE. This way the administrative and audition tasks are accessible, and make value in communicating the expected outcome of the project. Also, an external review is recommended to financiers. In order to confirm the orientation of the CE project/portfolio with the features different defined, as no global certification exists for circular companies or projects. So, second opinions and verification is also key to comply with the desired CE.

4. INTRODUCTION OF THE FINANCING MODELS

4.1. Introduction

Summarizing the firsts chapters of this project, we have seen how since the global crisis of 2008 and with the introduction of SDGs, the construction sector has changed. Some of the measures are already being implemented (energy transition, LCE), and that is why the concept of sustainable construction has had more meaning recently. Furthermore, we have seen that in order to achieve any goal in sustainability, there is a huge dependence on whether the stakeholders involved decide to give a certain level of preference or not.

Also, towards this aim of sustainability, we have seen that a change in the linearity of the economy (being used until this past decade) is needed. Thus, new interpretations (like circular economy) are creating products that add further value once its life has ended. In this intention for circularity, we have seen how financiers play a key role in granting finance to projects that comply with sustainable business models.

Once these chapters have been introduced, this research will now move to its core analysis.
In this chapter 4, a description of the various financing models, regarding their main features and similarities among them is made. The financing models to be considered are: *microfinance, impact investment, land leasing, project finance and infrastructure project bond*.

4.2. Micro finance

Micro financing is defined as a type of banking service provided to unemployed or low-income individuals. These groups, have not enough income to do business with traditional financial institutions, so otherwise would have no other access to financial services [31]. Through loans, savings, insurances and fund transfers, microfinancing seeks to give impoverished people opportunities to become self-sufficient. It has also a perspective towards entrepreneurs and small business, that also lack access to traditional banking services.

Furthermore, micro financing has been adding into its practice both social and economic development concepts. This combination has guided the creation of a rising number of sustainable micro finance institutions. Thus, micro finance is evolving towards a development strategy, balancing development and finance [32].

The basis of a micro finance policy are the development of a monetary stability and expansion of the financial infrastructure of a country to meet the financial requirements for micro, small and medium enterprises [33]. However, prior to achieving a solid economic growth and development, well determined policies and programmes need to be put in place. These policies, develop people's access to factors of production (credit facilities) and improve the poor entrepreneurship capacity through the provision of microfinance services. The main feature of these services includes the smallness of loans advanced, the absence of asset based collateral and simplicity of operations [33].

In order to carry out activities related to micro financing, the founding of Microfinance Banks (MFBs) is needed. These can be established by individuals, groups of individuals, community development associates, private corporate entities, or foreign investors [33].

They are responsible of a Central Bank, that regulates the licensing and checks whether the requirements stipulated are met. MFBs serve the following different goals:

a) Provide diversified, affordable and dependable financial services to the current poor, such that are able to develop long term, sustainable entrepreneurial activities.

b) Mobilize savings for intermediation.

c) Create employment opportunities and increase the productivity of the current poor, thereby developing their individual household income and standards of living.

d) Enhance participation of the poor in socio-economic development process.

e) Provide actual paths for the administration of micro credit programs of government and high net worth individuals.

f) Carry out payment services (salaries, pensions) for various range of government.

Furthermore, some of the challenges that MFBs face include poor capitalization and limiting and controlling procedures. The low capital base and the isolated mode of operation have hampered any significant contributions to financing activities. Also, problems related to corruption and lack of adequate skilled professionals in the bank industry, that adds to the efforts from stakeholders not to adhere microfinance policies. Even though MFBs are established by Central Banks, the responsibility of corporate governance relies in the microfinance banks. The board of directors is responsible for the establishment of strategies and policies to meet both activities of the bank and its means.

When microfinance institutions (MFBs) become part of the financial system, they can access capital markets to fund their lending portfolios, allowing to reaching major number of poor people [32]. Thus, then microfinance directs itself towards development objectives. It has the ability to create structural changes in the way in which capital is made accessible to a population. Also addresses the issue of creating the infrastructure to rearrange resources and to create wealth among poorer sectors.

The focus of micro finance is that its institutions reach the poor sectors of society and simultaneously achieve financial permanence. However, the component of innovation should not be forgotten as its key for the connection with development. If finance and development are not combined by integrating the major fundamentals of each, micro finance attempts will fail [32]. Either because one will gradually forget its target market, as it pursues quick profits; or because it ignores the basic principles of finance.

4.3. Impact investment

Impact investment can be defined as actively placing capital in businesses and funds that generate social and/or environmental good, and at least return nominal principal to the investor. This recognition of double meaning (investing for social/impact and the impact that could have on investing) goes under different names like: social investing, blended value, responsible investing or triple bottom line [34].

In order to break down this definition, we can consider impact investment as a sub term for responsible investing (which takes environmental, social and governance aspects into consideration in investment decision making). However, in impact investment the investor intentionally invests to achieve positive social and/or environmental impact, in addition to financial return. It extends diverse asset classes, including: real estate, private equity, infrastructure, public equities and fixed income [35].

Furthermore, the market for impact investing is estimated anywhere from $1 to $14 trillion, when global infrastructure investment is included (affordable housing, clean technology,

water systems, transportation systems…) [36]. In developing countries, the potential invested capital required in affordable urban housing alone, ranges from $214 to $786 billion [36].

According to the Monitor Report in 2009 the classification for impact investors can be made in two groups based on their primary objective:

- *Impact first investors*, those who seek to optimize social and environmental impact above financial return. They are prepared to take lower returns on their capital to achieve the impact they look for. Typically, impact first investors experiment with diversification of their social change approach, seeking to control market mechanisms to create impact. These investors are generally found in philanthropic community.

- *Financial first investors*, those who seek to optimize financial return above social or environmental impact. They basically look for market rate risk-adjusted return on investment, while achieving some social or environmental good. To do so, they integrate social and environmental value drivers into investment decisions, look for outsized returns that lead to create some social value, or in response to regulations/ tax policy.

The purpose of this segmentation is that motivation would determine the types of investments any particular actor will consider, without concerning with the sector or geography in which they invest. It is true that investors who are only looking to maximize their profits, can actually make an impact investment unintentionally (because while maximizing profit sometimes it also yields impact); only those investors interested in some impact in particular, would be motivated enough to aim for these opportunities and place their capital.

However, the promising aspect of impact investment lies when the two types of investors work together. In these deals, there is a combination of capital from impact first and financial first investors plus the addition of philanthropy. These arrangements can enable deals that could not take place without the integration of types of capital with different requirements and motivations. So, *"much more capital can flow to deals that otherwise only impact first investors would pursue. And much more impact can occur through deals that financial first investors would pursue but where they might not be willing to invest more to ensure the impact"* [34].

Also, this combination of the two types of investors is done in order to measure the impact created by the investment. Notice that while we can actually measure the financial performance or fulfilment of these investments, it is much more challenging to quantify the social or environmental impact that the investment may have. Thus, with the deal of blending impact first and financial first, the impact can be measured as a whole (both financially and socially/environmentally).

Some examples of these kinds of deals are the market rate mortgages that enable affordable housing projects to be built; expansion of capital to medium scale businesses to generate substantial job creation; investments made in infrastructures that provide communities with clean water, sewage systems and sustainable transportation.

Once we have developed the concept of impact investing, we can notice some connections with microfinancing. It is true that impact investing includes micro finance opportunities, but goes further than providing small loans and financial services to individuals in developing countries. Rather than investing in individuals or groups, impact investment focuses its investment towards companies, funds or organizations.

Another point of connection between these two models is in the fact that either when lending a micro credit or making an impact investment, there is some calculated risk to compensate for charging interest, or some equity at the company. However, the amount of risk taken and size and location of the investment are variable [37]. For example, for an investment made in an individual in a developing country (micro finance), whereas the investment can be relatively low in quantity, the risk (political, geographical…) associated can be relevant. Instead, for an investment in a fund, organization or company are of larger amounts; the enterprise where the investment is made has a proven financially sustainable business model.

Last, both impact investment funds and micro finance companies exist all around the world, in developing and developed countries. Yet in developing countries, impact investors invest in smaller organizations that include micro finance organizations; while in developed countries, impact investors focus on solutions that serve vulnerable sectors of society [37].

4.4. Land leasing

Financial leasing can be defined as a contract between two parties where the lessor provides an asset for usage to the lessee for a specific period of time, in return for explicit payments [38]. However, in practice, leasing is referred to as asset-based financing. Lessors retain ownership of the assets they lease throughout the basis of a contract, so these leased assets are indeed an inherent form of collateral in such contracts. Basically, leasing separates the legal ownership of an asset from its economic use [39].

Drury and Braund (1990) [40] summarized seven main reasons why companies may choose leasing instead of alternative sources of finance:

a) Timing differences, different accounting year-ends which enable the lessor to capture the depreciation tax shields earlier than the lessee.

b) The lessor can borrow at a lower rate than the lessee.

c) Equality of costs, between leasing and borrowing.

d) Lease finance can be obtained with greater facility and fewer restrictions.

e) Leasing can provide off-balance sheet financing.

f) Operating leases provide an important protection against the risk of obsolescence.

g) Managerial motivations to lease for reasons of self-interest.

According to the International Finance Corporation (IFC), during the period from 1974 to 2009, more than 220 leasing projects were financed for 130 clients in 58 countries for $1.4 billion. Furthermore, also during that years, the IFC carried out the establishment or improvement of leasing regulations in 60 developing countries [38].

Once we have established the general meaning for (financial) leasing, we are now going to see how is applied as infrastructure-financing option.
Governments have a wide variety of assets on their balance sheets: from infrastructure networks to public buildings, from housing to municipally owned enterprises, among owned land [41]. The sale of these assets has some interest since it has been recognized as a possibility for financing infrastructure investment. However, asset sales as a practice has been viewed as a temporary financing resource, as government's decisions were to exit activities related to the provision of public housing or the operation of economic initiatives that compete with private sector. Thus, fiscal experts have warned not to become dependent upon these sales, as a significant source of capital financing [41].

In this context, land assets can actually sustain the infrastructure finance for a longer period of time. Notice that this type of assets is non-static, as can be created by expanding the urban area into rural zones at the urban border. However, instead of selling the land there is a larger commitment to convert land assets into infrastructure by ***land leasing***. The general concept is to finance urban infrastructure investments directly from leasing the land assets, while borrowing against the value of land on the government's balance sheets to finance much of the remainder [41]. Land leasing started with the aim of stimulating local economic development, by allowing cities to attract foreign investment by providing reliable land occupancy terms to investors. With the large source of income generated, cities invested those revenues primarily in infrastructure systems, enhancing competitive position for economic growth.

The procedure is simple: a purchaser of a land lease acquires the land rights for a period of 40 to 70 years, depending on the property type. This land that is sold and the agreed for development can be reclaimed by the government if it is not developed within a period. Even though direct incomes from land leasing sales is the main focus to land assets, the function of

publicly owned land in urban infrastructure finance has more extend. Borrowing from state owned banks can finance part of the remaining urban infrastructure investment. So, this borrowing corresponds to a debt in the balance sheet, which is secured by municipally owned land. Then, debt service can be paid by selling off the leasing rights to parcels of land whose value has been accentuated by the debt financed infrastructure project.

As *Peterson (2006)* [41] states in the World Bank Policy Research, due to the mentioned importance of land leasing revenues to cities' infrastructure investment, governments have turned into land market entrepreneurs. Municipalities try to acquire large quantities of land at the cheapest possible price, to use it as collateral for infrastructure loans. One way to obtain land is by moving stated owned companies, from central locations to urban bounds. This way companies have better transportation access and the land is cheaper, allowing to lease the vacated land to developers. Another way municipalities have is by designating areas of deprived housing or small scale business for re-development. So, the government is upgrading infrastructure, and then selling the rights for land leasing for re-development.

To sum up, land leasing can actually generate important revenues that are able to finance infrastructure projects. Furthermore, in growing economies where urbanization grows at a fast pace, using land assets to accelerate infrastructure investment is effective. However, notice that the supply of land available for leasing at some point will run out. Thus, land leasing is considered as a transitional infrastructure finance strategy [41], that makes sense as a part of a program to activate urban infrastructure investment.

4.5. Project finance

Project finance can be defined as a financing model that a priori does not depend on the reliability and solvency of the sponsors (known as parties that propose the business idea to launch a project). In other words, the approval of a project is based on the function of its ability to repay the debt contracted, while remunerating the capital invested at a rate in accord with the degree of intrinsic risk in the venture concerned [42].

Commonly, project finance is known as the alternative to corporate finance that sponsors have when financing a new project. The main difference is that while a new initiative with corporate financing is financed on balance sheet, project financing is off-balance sheet. Instead, incorporates the new enterprise into an economic entity known as special-purpose vehicle (SPV) [42]. SPVs or the project company, are created by sponsors using equity or debt (mezzanine) for which the lenders considers cash flow as the main source of loan repayment, while considering assets only as collateral.

The main advantage the firm has when creating SPVs for a project is that then, both the company and the new project take two different paths. If the project would not succeed,

project creditors would have a limited (or none) claim on the sponsoring company's assets and clash flows, which is a benefit for the firm's shareholders. However, the principal drawback of this alternative is the higher cost that structuring and organizing such a deal requires. This cost is justified as lenders are expected to pay significant costs in exchange for taking greater risks. Also, the time that the insurance advisors and the loan arrangers need for evaluating and negotiating the contract terms. Finally, adding the monitoring cost is what makes in overall project financing to be costlier.

In order to highlight the characteristics that project financing has, the focus is put on five main factors [42]:

- The guarantees for financing rely on the project asses.
- There is none or substantially reduced effect on financial elasticity for sponsors.
- The accounting treatment is done off-balance sheet, except for expenditures to subscribe equity in the SPV or for underling loans.
- Future cash flows are the only variables carrying the granting of financing.
- The degree of leverage available is depending on the generation of cash flows by the project, the prior frequently much higher

Apart from the project sponsor, the other main party that plays an important role in project finance are the lenders. Infrastructure projects involve large investments, and so a considerable fraction is generally raised in the form of debt from lenders (banks, specialized lending institutions or bond markets).

Traditionally, most infrastructure projects have been financed by bank loans. The concentrated ownership of bank debt encourages lenders to dedicate considerable resources to the evaluation of the project, and the monitor of its progress. Also, if the project company (SPV) experienced difficulties repaying the debt, there is a facilitation for a negotiation [43].

However, due to the increasing bond market appearance and a change towards more sustainable matters, there is a need for banks to adopt green strategies into their operations, buildings, investments and financing strategies [44]. In this context, green banking policies have emerged. The concept of green banking is referred to as banking regulatory policy that should pay attention to: the direct impact of bank operations, and the indirect impact of funds invested; by understanding the perspectives of sustainability development [45].

Notice that development cannot take place without having impact in the environment. Thus, the financial aspects of development need to contribute to the sustainability of the environment [45]. That is why the concept of green banking is making technological

improvements, operational improvements, and changing client's habits in the sector. Furthermore, there are some strategies (social and environmental) that can be incorporated into the development goals of banks, to effectively manage the environmental system [44]. According to *Biswas (2011)* [46], the environmental management in the banking sector is similar to risk management as it reduces the credit risk, improves the asset quality and increases the business value. In order to adopt this management type into the banking sector, four different policies are can be highlighted:

- Design the environmental system to evaluate risk involved before investing in different projects, through an environmental impact assessment (EIA).
- Adopt the annual reporting system (ARS), where an annual report shows the environmental risk guidelines for every project invested or financed.
- Implement environmentally sustainable technologies which minimize risk while saving cost and increasing the bank's reputation.
- Procedures like assessment of environmental risk, environmental audit management or assessment of loan follow up, need to be established before investing in different projects.

Even though banking activities are not physically related to the environment, but the external impact of their customer practices is essential [44]. Banks can help with the promotion of financial products to achieve the target benefits for sustainability [47]. Furthermore, the banking industry has an important role in supporting and enhancing the economic growth throughout financial and economic development projects.

4.6. Infrastructure project bond

Even though the definition of infrastructure has been previously developed extensively in section 2 of this thesis, the concept of bonds needs to be defined. These, are known as fixed income securities, that basically represent a loan made by an investor to a borrower [48]. Bonds are used by both corporates and governments to finance projects and operations.

Furthermore, the bond market for large scale infrastructure projects is addressed to institutional investors (insurance companies and pension funds), as they have longer term investment needs that match quite well with the long-term nature of infrastructure assets. The aim is to promote the development of capital markets for financing infrastructure projects for transport, communications, energy [49].

Although infrastructure bonds can be embarked as loans to specific infrastructure project, it was not after the Global financial crisis of 2008 that grew attention. At that time, investors were looking for more "real assets", as it felt more solid than other complex products where

the underlying value is more difficult to detect. Furthermore, the financial crisis also imposed much firmer capital and liquidity requirements for commercial banks, reducing their ability to provide funding (by loans) for infrastructure projects [49]. But also, as the recovery rates are much better for infrastructure bonds than corporate bonds, it introduces more favourable capital for infrastructure bonds. In this context, infrastructure was presented as an alternative asset class, which could be placed between government bonds and corporate bonds; and different to mainstream equities and bonds such as real estate, private equity, hedge funds… [50].

In order to illustrate how the investment in project finance bonds related to infrastructures has been increasing world-wide in the following years after the crisis, *Esty et al. (2014)* [51] gathered it by sectors in the table 4.1. Notice how from a sector perspective, mainly the large majority of project bond capital during that period was set aside to finance infrastructure ($34.713 m), oil and gas ($26.368 m), and power ($21.655 m). On the contrary, social infrastructure (facilities principally related to healthcare and education) has one of the lowest growths (9.32%), against the 36.29% of infrastructures.

Sector	2011	2012	2013	Total 2011–2013	Percentage of Total
Infrastructure	6.033	9.796	18.884	34.713	36.29%
Oil & Gas	5.148	5.905	15.315	26.368	27.56%
Power	5.448	7.108	9.099	21.655	22.64%
Social Infrastructure/PPP	5.315	961	2.643	8.919	9.32%
Petrochemical	0	183	3.200	3.383	3.54%
Mining	335	174	0	509	0.53%
Leisure & Property	0	0	0	0	0%
Telecommunications	0	0	114	114	0.12%
Total	22.279	24.127	49.255	95.661	100%

***Table 4.1** - Project finance bonds by sector ($ million)* [51]

Talking now more specifically of the economic and financial characteristics of infrastructure assets, five main aspects can be highlighted: (a) high barriers to entry; (b) economy of scale (i.e. low variable costs); (c) rigid demand for services; (d) low operating costs; (e) long duration (both in concessions and leases). As a consequence, the value approach of infrastructure as an asset class is to captivate engaging financial characteristics [50]. The most relevant are:

- Attractive returns
- Low correlation of returns with other asset classes
- Long term, predictable and stable cash flows
- Low default rates

- Socially responsible investing

To sum it up, *Inderst 2010* [50] gathered the economic based principles of infrastructures, stating that are supposed to offer investors: *long-term*, *low-risk*, *inflation-protected* and *a-cyclica*l returns.

Regarding the obstacles that project bond progress can face, according to *Rossi and Stepic (2015)* [52] it can be identified as four. First, commercial banks still consider *capital markets as competitors*, because financing projects has been traditionally the major source of fee business for banks. Next obstacle makes reference to the attitude that borrowers have towards capital markets, as they usually feel *more comfortable with banks* and do not consider them that much vulnerable. The third difficulty is with investment bankers, as they may be interested to develop infrastructure bonds when there is a *perception for repeated progress*. Only then, they will invest the considerable up-front cost needed to arrange complex project bonds. Last problem occurs as bond investors are less prone to run *risks associated* with the construction phase. Instead, they would only assume risks in the operation phase.

5. IMPLEMENTATION OF THE FINANCING PRACTICES BASED ON THE ENVIRONMENT

5.1. Introduction

In the previous chapter, we have answered the first of the approach questions that were originally planned to conduct this research. As the different financing models have been detailed, the differences and similarities between each one of them are recognized, and thus the question answered.

In the next section 5, the focus will be towards the implementation of these various models, looking to answer the last two approach questions. These, make reference to the degree of application of the explained financing practices and the implications of these practices.

To do so, we will be focusing on the environment, differentiating between developing and developed countries. Thus, for each two regions, the current implementation of these models along with some examples where it has been implemented will be described. If any financing model is not currently found in a region, the possibility for implementing it will also be discussed.

It is important to highlight that the implementation of the different models depending on the environment is done based on the characteristics of each one, and where are more viable to be implemented. However, it does not mean that the opposite is not doable, but is less likely or none case examples have been found.

5.2. Developing countries

While mainly all the developed countries have certain standards of wealth, it does not happen the same for developing ones. So, many developed countries do not have the resources to stimulate the economy and protect at the same time the social disadvantages of their population. Furthermore, developing countries suffered differently the global crisis of 2008. The more the country was interconnected with the world economy, the greater the effects. Thus, the disparity among countries of this environment was accentuated.

Some financing models require of certain levels of wealth stability, while others are more designated to bare economies. So, not all the different financing models to be implemented in developing countries, will be applicable for every country. And that is mainly due to the disparate economic and social situation on developing countries.

In this context, the three financing models that are considered for developing countries are: *microfinance, impact investment and land leasing*.

5.2.1 Micro finance

The first financing model that is going to be considered is *Micro finance*. Known as the type of banking service which is provided to unemployed or low-income individuals, it has a clear focus towards developing countries. It aims to develop the financial infrastructures of a country to a point where are is to meet the financial requirements for micro, small and medium enterprises, on its own.

Furthermore, through microfinance institutions (MFIs) a policy framework can be set. This, would improve the establishment of microfinance services on a long term sustainable basis for the low-income groups. There are different numbers of strategies to follow in order set up these institutions in a developing country [33]. MFBs are the most common vehicle to implement microfinance. So, licensing and regulating its establishment along with strengthen the regulatory framework is one of the main policies to develop. Some other microfinance approaches can be summarized as follows [33]:

- Promoting the establishment of NGO-based MFIs.
- Supporting the participation of Government in the microfinance industry, by enhancing local administrations to devote 1% of their annual budgets into micro credit initiatives through MFBs.
- Strengthen the capital base of existing MFIs.
- Mobilizing the domestic savings and promoting the banking culture among low-income groups.

- Promoting the establishment of MFIs that support the development and growth of microfinance service providers and clients.

These are different strategies that encompasses the policy framework in which countries should establish themselves. It should all be sufficiently capitalized and suitably regulated and supervised, in order to address the need of financing at micro levels of the economy.

Even though Microfinance has its origins in the 80s, recently it has acquired more importance. During the 2017 MFIs reached a global portfolio size of $114 billions, which represent a rising average over the last years (8.6% on 2015, 9.4% on 2016 and 15.6% on 2017) [53]. In order to break down this global portfolio, the following table (*Table 5.*1) is presented:

Geographic region	Portfolio Size ($ bn)	Nº of borrowers (M)	Nº of MFIs
World Total	114	139	981
Latin America - Caribbean	49.8	23.4	275
Africa	9	6.8	160
Middle East - North Africa	1.6	2.6	30
East Europe - Central Asia	7.2	2.8	142
South Asia	27.9	83.8	224
East Asia - Pacific	19.1	19.2	150

Table 5.1 - *Inclusion of MFIs in the different regions worldwide, in 2017*

The information above shows the different regions where MFIs are present worldwide, based on the portfolio size and number of borrowers. South Asia leads the global outreach in number of borrowers, almost two-thirds of the total. However, in portfolio size and number of MFIs, the Latin America – Caribbean region is the one that takes the lead. With a portfolio representing more than the 40% of the total, is also the region with the highest ratio of portfolio $ bn per M borrowers.

Last, we can see how there is a general relation between the number of MFIs and the portfolio size on the regions. The region with the lowest number of institutions is also the one that has a lower portfolio (Middle East - North Africa). Thus, this emphasizes the need for establishment of MFIs in order to be able for microfinance infrastructures to succeed. Also, it highlights the importance MFIs as the policy framework that actually is suited for establishing microfinance in developing countries.

5.2.2 Impact investment

Next financing model to be analysed based on its implementation capacity in developing countries is *Impact investment*. This term can be enclosed into responsible investing

(investment decisions which take into account environmental and social aspects), but with the firm intention of achieving positive social, environmental and financial return.

Impact investment can benefit the population in emerging countries, and is already having positive effect for society while having positive financial returns. For example, just in the housing sector alone, a potential profit opportunity ranged between $177 - $648 bn is expected until the 2020; or for the clean water infrastructures, a potential of up to $7 bn is also expected in the same period [34]. Whereas impact investment is also developing methods of working that intentionally benefit society, in ways that neither grant making and capital markets can accomplish alone.

However, the lack of capital in developing countries is a critical problem in the not for profit sector, while some alternative sources of capital are unable to be build [54]. In this context, impact investment might offer different solutions through the development of institutional forms for policy makers. These policy suggestions can be viewed from different sides [54].

Regarding the *demand side*, the prerequisites for a healthy industry are mainly two. First, the segmentation of investment opportunities; and second, new financial mechanisms that fit with multiple social/economic goals, plus qualities like innovation, inclusion or sustainable change. For the *supply side* requirements, we can highlight the need for financial options within all stages of the organizational lifecycle, and the incentives in order to diversify the funding and income base. Yet, the decisive element in the development of an impact investment market is the *role of government*. It can be classified under three categories:

a) Supply development policies: those that increase the amount of impact capital, and deal with investment rules and provide co-investment; by basically assigning investments or attracting investors through risk-sharing with government.

b) Policies changing the direction of capital: in markets, towards impact opportunities that modify the perceived risk and return characteristics; by adjusting market prices and costs while improving transaction efficiency (such as tax incentives for social investments).

c) Demand development policies: those that build demand through institutional capacity, enabling structures and contributing to impact investment related projects and capital beneficiaries; like the government infrastructure switch towards regional and local authorities.

So as to illustrate how the government uses different policies to catalyse the impact investment, we are going to analyse the case of India. In 2014, the Indian NAB (National Advisory Board) was created as a network that engages with different institutions (like the Ministry of Finance or the Reserve Bank of India), to inform government policies on impact investing [55]. According to the *Working Group Report* from 2018, the following graph is

presented (*Fig 5.1)*. It shows the different policy tools that already exist or are currently in progress in India, and the corresponding government market contributor in charge.

When the government acts as the market facilitator (meaning a central government unit), we can highlight the existing NAB responsible of the collaboration between government and the private non-profit sectors. While in progress there is the wholesaler as intermediaries, which are funds that provide catalytic capital to impact driven investment. This policy is considered the costliest as a market facilitator. For the market participant, the government looks at how to structure their own spending. A measure already used in India is the access to capital. Even though is costly for the government (as acts as the largest purchaser of goods and services), this policy provides funding through programmes to impact businesses or impact driven funds. Last, for the market regulator regarding the implementation of standards and legal forms for impact businesses. India already has a specific legal form, that focuses on the societal and environmental contribution before the profit generation. Also, some financial incentives are currently being developed as it is a costlier policy.

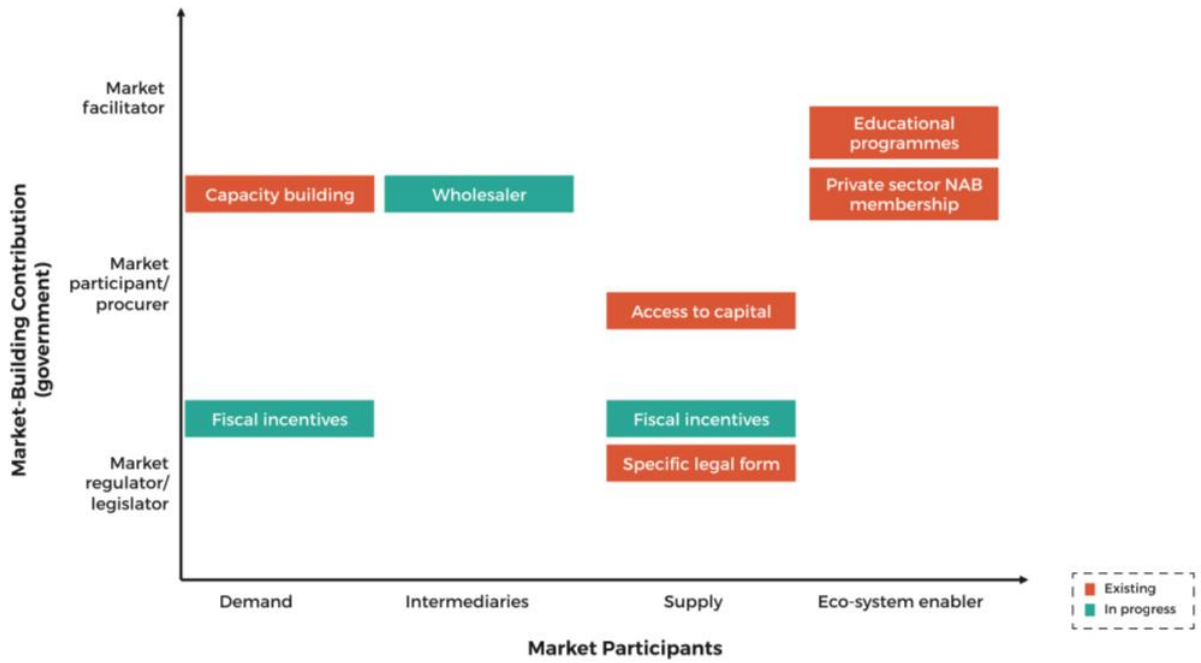

Figure 5.1 - *Existing and in progress policy tools by the government in India [55]*

We can consider that in order to impact investment policy suggestions to hold, it should rely on governments to be established in the market. It is true that challenges will vary based on the investment practices, regulatory environments and culture of the different geographic regions. Yet, the lack of supply of capital is a common element in developing countries. That is why the role of governments and the public financing system is key in order to support the start-up and growth of investors aiming for social returns.

5.2.3 Land leasing

The third financing model to be considered is *Land leasing*, which in general terms aims to finance urban infrastructure investments through leasing the land assets. As explained in the previous chapter, land leasing stimulates local economic development, as allows cities to attract foreign investments by providing reliably occupancy land terms to the investors.

The undercapitalized banking system of developing countries is only able to offer limited range of products to potential clients. The leasing sector increases this range of in the marketplace and provides different paths for accessing finance for businesses than else would not have it. In a study carried out by the International Finance Corporation, it is described how the level of lease penetration in relation to the GDP is much higher in emerging economies, and even to room for growth in the use of leasing too [38].

Furthermore, the experience in different countries (China, Ethiopia or India) suggests that urban land can, under different conditions, generate significant amounts of revenue that can help finance local infrastructure resources. Thus, financing part of urban infrastructure costs from land appears to be feasible in countries with two characteristics. That in the first place have public ownership of land; or that have institutional arrangements allowing special authorities to acquire and sell/lease land associated with infrastructure projects.

Even though the monetarization of public held land may generate abundant revenue sources for local governments, it also brings in different risks that can affect fiscal management. So, while some emerging countries might satisfy some of the characteristics previously mentioned for implementing a land leasing policy, the reliance on this revenue involves risks that need to be recognized [41]:

- *One known risk* involves the use of the assets to finance the municipal operating costs. So, municipalities with access to land leases revenues start to depend upon these revenues for more than investment purposes, and the receipts spread to become part of the operating cost itself. Then, once they depend on the land asset, but the assets are gone, they would face severe budget shortfalls, which the government would have to absorb. In order to limit this kind of risk, the central government could restrict or limit the municipal borrowing.

- *Another risk* takes place when land leasing is related to the danger of a real estate bubble. Usually land prices have as an advantage a long-term upward trend prices, in relation to the economic growth and urbanization. Yet at the same time these prices are very volatile. Thus, the risk comes when land and property values become the primary source for borrowing. Then in an event of collapse in land or real estate prices would crack the financial system. To limit this risk, the banks that make loans for municipal investment, should evaluate land at its current market value rather than a projected value after the infrastructure is build.

In order to have a look at a successful land leasing process and its implementation, we will analyse the case of China. According to *Peterson (2006)* [41], during the end 90s and beginning of the 21st century, China made the largest scale commitment to converting land assets into infrastructure. It started as an experimental basis as part of a decentralization of China's fiscal system. Until that time, public authorities allocated land organizationally and land use was free. So, with the inclusion of a land-leasing system the intentions were to stimulate local economic development; and the large source of income were invested essentially in infrastructure systems, improving cities' economic growth.

With different law and fiscal reforms, land leasing was becoming a public policy, and so more important cities adopted it as a practice, while at the same time municipalities were gaining control over an important revenue source within their control. To get some perspective land leasing as an infrastructure financing tool, the following table is presented.

City	Period	Revenue Raised
Shanghai	1992-2004	more than RMB 100 Bn
Shenzhen	throughout 1990s	80% of total government revenue
Beijing	1995-1996	RMB 6.9 Bn
Hangzhou	2002	RMB 6 Bn

Table 5.2 *- Revenue from land leasing in selected cities of China, in RMB*

The table above (*Table 5.2)* represents the total revenue produced through land leasing in the selected cities in China. Note that the revenue is in RMB, which equals to $0.125. We can see how during the period of maximum implementation of this practice, cities like Shenzhen practically raised their complete budget on land leasing. Hangzhou for example, even though land leasing is implemented at a later stage than other cities, in just one year raised over $750 million.

These numbers illustrate the potential of land leasing implementation during a period of urbanization and decentralization of an emerging country. However, different studies highlight the fact that direct revenues can be generated as a significant part of a municipal capital budget, for a period up to 10 or 15 years. After that, attention has to be paid in the possible risks allocated if depending solely of a financial system like this.

5.3. Developed countries

According to different studies, since the mid-2000s there has been a growing amount of money available by pure financial sponsors for project and infrastructure finance transactions. The main reason is the huge infrastructure gap worldwide paired with an increasing public

spending constraints [42]. In developed countries, to this infrastructure break we have to add the sustained levels of liquidity in the capital markets following the financial crisis of 2008.

In order to get a reference of the mentioned gap, the Organisation for the Economic Co-operation and Development (OECD) in 2007 and the McKinsey Global Institute in 2013, measured the amount of infrastructure investment required for 2030. For the group of transport and electricity (generation and distribution) infrastructures the calculation is between $57 to $67 trillion; and for water and telecommunications infrastructures up to $71 trillion.

In this context, the funding of infrastructure investment has increasingly moved into other sectors. The main two forms for developed countries are *project finance* (to fill in the gap left by the public sector) and *infrastructure bonds* (that considers infrastructure as an asset class itself). Also *impact investment* is going to be considered in this environment, but as we are going to see just on a specific context.

5.3.1 Project finance

This financing model is based on a SPV (also known as project company) which is the one that build and/or operates a piece of infrastructure, and is established by other pre-existing larger companies in sectors related to that of the SPV. The different enterprises or sponsors invest as stakeholders, which are the ones in charge of using the debt or equity for the loans repayment. Notice that the main difference with corporate finance, is that project finance is off balance sheet, as it works through the mentioned SPVs.

The implementation of a project financing has to face different challenges, including a time consuming and difficult operative process. Even though each project has a unique time schedule depending on the particularities and circumstances of the project, some common paths of action can be highlighted [56]. Furthermore, a conflict of interest arouses among the many parties involved, and so the management position has great importance in these types of projects. Usually the lenders have the best position to manage effectively and handle the project from its inception to the financial close, as an understanding of all the aspects of the project with an interpretation to evaluate the overall risks is needed. However, it is also possible for the sponsors to adopt the whole control for managing the project.

The figure below (*Fig. 5.2*) shows a timetable of the more important milestones for a typical project and how long are expected to take. The first initial phases are related to the agreement lf the sponsors on the project feasibility and the following establishment of the SPV. The second and one of the largest phases is related to the development of the financing term sheet. This includes the selection of the banks, agreement on the loans and security, all with the final approval of the shareholders. Last important phase is in charge of the bank, which has to approve the technical aspects along with insurances needed for the project. Finally, the

financial and legal approval is done, concluding with the signing of the conditions and the first drawdown.

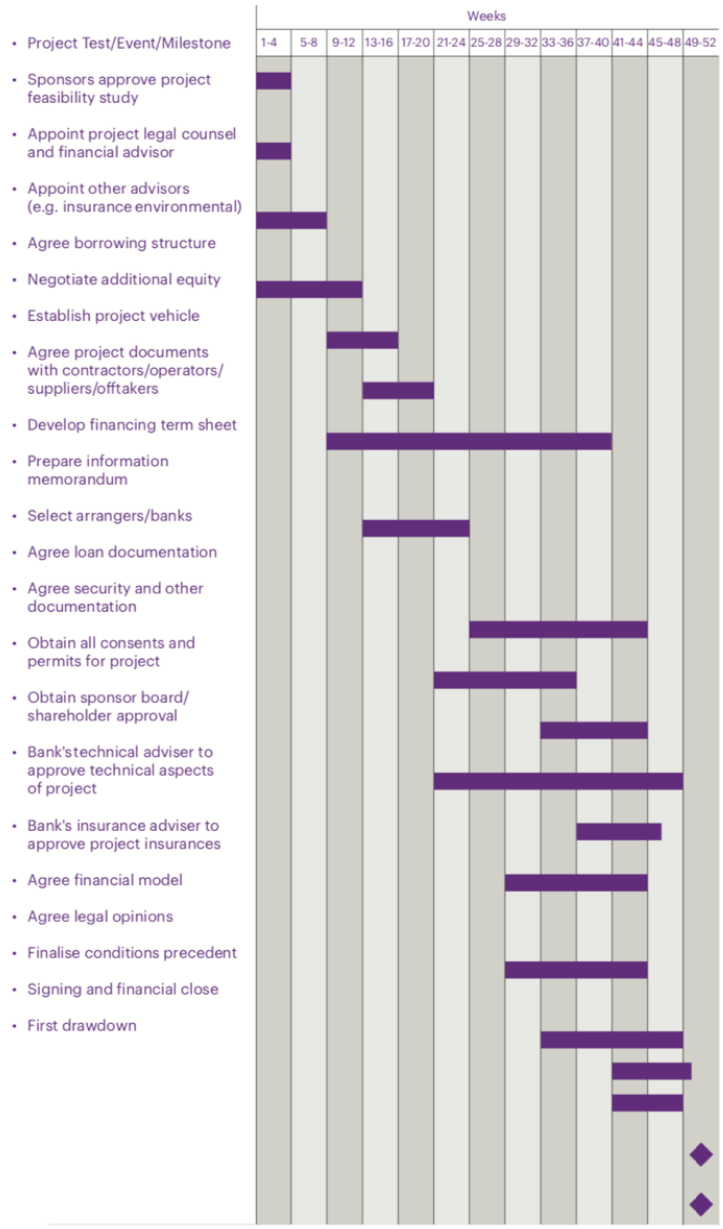

Figure 5.2 - *Typical programme schedule for project financing [56]*

In this context, there are some international experiences of countries that have implemented different programmes in order to accelerate the procedure for project financing, while trying to solve the problem of the existing infrastructure gap. One of these countries has been the United States.

According to a report from the American Society of Civil Engineers (ASCE) in 2016, in the US there is a potential loss of competitiveness due to the very poor condition of infrastructure (mainly transport facilities). They concluded that if the infrastructure gap is not addressed by 2025, the US economy would expect a loss of almost $4 trillion in the GDP [57]. With the idea of reverting this situation, the TIFIA program (Transportation Infrastructure Finance and

Innovation Act) was reauthorized with a direct funding of: $275 m (in 2016 and 2017), $285 m (in 2018) and $300 m (in 2019 and 2020) [58]. This program is administered by the Department of Transportation's Build America Bureau, and the main purpose is to provide direct loans to qualified infrastructure projects, of both regional and national implication, with at least $50 m of eligible cost. Furthermore, the main attractiveness of the loans provided are the low cost, long duration and flexibility in the repayment terms, measures that are hard to match by the private capital market [58]. The different types of projects eligible for TIFIA are:

- Highways and bridges
- Public transportation
- Transit oriented development
- Intercity passenger bus and rail
- Intermodal connectors
- Intermodal freight facilities
- Capitalization of rural projects

To sum up, we have seen how the project finance method can mean that such projects can be constructed years earlier than when relying on the pay-as-you go funding. TIFIA is one example on means to accelerate project delivery, and the benefits that afterwards flow from the infrastructure.

5.3.2 Infrastructure project bond

Apart from loans, there is another potential source of finance for projects which is the bond market. This form, even though it is not characterized by the flexibility that loans have, offers the availability of a long-term fixed rate funding. Thus, it improves significantly the economy of the project, as the fixed rate allows for a lengthening of the repayment debt [56].

So, as an alternative to loans and with the bond market as base, we have the last financing model to be considered: *infrastructure project bonds*. These are fixed income securities, but instead of a loan the infrastructure is presented as the asset class itself. The main characteristics that this type of asset offers to investors are: *long-term*, *low-risk*, *inflation-protected* and *a-cyclica*l returns [50].

In this context, infrastructure bonds can be presented as a different way to tackle the gap in infrastructure previously mentioned. According to a report by the World Economic Forum (2014), the various policy recommendations in order to implement an infrastructure investment framework, can be classified in three categories [59].

- A *strategic infrastructure vision*, that increase the interest of investors by aggregating a credible pipeline of future projects, with a clear role for them. Investors should be able to see a long- term goal, along with underlying economic and social foundation.

- Different *key regulatory enablers* address critical impediments to the infrastructure investment. The main measures are to limit a renegotiation risk, review and asses the tax policy, and facilitate project permitting processes. The goal is to create a stable regulatory environment, that lowers expenses and cost of capital for investors.

- An *investor value proposition* present in each potential project, so as to analyse project financial returns from the point of view of the investors. At the same time, a risk allocation methodology needs to be created. The main outcome are bankable projects that attract investor interest and maximise value.

These are some of the policy recommendations needed to assess investors towards infrastructure projects, against a multitude of alternatives in other asset classes. So, the more effective regulatory environment and reliable projects a country has, it will bring in more investment at lower cost [59]. At the same time, usually policies that are of interest to private investors tend also to benefit society. So, governments can still focus on seeking private investment that it will add simultaneously economic value and social benefit.

The same report considers that a conflict exists between the need for infrastructure projects and the capital made available by investors. That is why, different countries have set up initiatives to finance infrastructure investment through bonds. One of the main programmes is promoted by the European Union together with the European Investment Bank (EIB), known as Europe 2020 Project Bond Initiative (PBI). It was launched as part of the 2020 Agenda of the European Commission in 2010. With this initiative, the EU aimed to use funds for credit development to increase the desire of institutional investors (pension funds and insurance companies), to enhance large-scale infrastructure financing [49].

The same 2020 Agenda estimated that the infrastructure gap in Europe is about €1.5-2 trillion to be invested in energy, transport, and information and communication projects; in order to promote economic growth, employment and convergence across EU regions [49]. So, the PBI initiative recognizes the capital bond market as an alternative source for funding the infrastructure needed. To do so, through the EIB, the EU has established a two-way methodology in order to reduce risk exposure by lenders. It provides either a layer of subordinated debt, which will reduce the debt portions, or a stand-by liquidity facility to the project, which will provide funding if the incomes generated by the project are not enough to repay the debt [49]. These two-form methodology is guaranteed by the EIB up to a certain point, and improve the credit quality of the debt. Last, the EIB is the one in charge of the evaluation and selection of the projects, structuration of the financing instrument and of monitoring the projects.

The EU and the EIB launched a pilot phase of the PBI in 2012, to test how this initiative could: first help to finance priority projects that added value, and second provide access to capital markets as an additional source to finance infrastructure projects. For this phase that ended in 2015, more than €4 bn were committed by the EU as total cost for seven different projects of the Trans-European Transport Networks (TEN-T) [60], which are summarized in the table below (*Table 5.4*).

Project	Country	Sector	Signed Date	Bond Issuance
Castor	Spain	Energy	July 2013	€1.4 bn
Greater Gabbard	UK	Energy	November 2013	£305 m
A11	Belgium	Road	March 2014	€578 m
Axione	France	Telecommunication	July 2014	€189 m
A7	Germany	Road	August 2014	€429 m
Gwynt y Mor	UK	Energy	February 2015	£339 m
Port of Calais	France	Water	July 2015	€504 m

Table 5.3 - *Projects financed during the pilot phase of the PBI, 2012-2015*

The information above offers an overview of the different projects that have been financed using infrastructure bonds, during the pilot phase of the PBI. We can see how there is a variety of sectors and countries in which this initiative can be applied. The energy sector has the most projects involved, Castor being a gas storage plant and both Greater Gabbard and Gwynt y Mor an offshore facility. Also, even though the Castor project has the highest cost with €1.4 bn, it is not the one that received the highest contribution in % from the EIB budgetary commitment. The Axione project, with a total cost of €189 m, received a financing of 30% of this cost (€58 m) from the EIB, being the highest participation of the institution. Contrarily, the EIB only guaranteed 15% of the bond issue in the Greater Gabbard project, the lowest in all projects [60].

To conclude, the PBI initiative resulted useful in facilitating the development of the capital market financing of infrastructure during its pilot phase. All of the seven projects achieved were appropriate, so the EU contribution was proportional to the number of projects supported and the expected efficiency. Basically, it demonstrated that an infrastructure bond financial instrument, like the PBI, is able to add value while developing infrastructure.

5.3.3 Impact investment

As explained previously, impact investment is a financing model that targets specific social objectives along with a financial return, measuring the achievement of both. We have seen

how for developing countries, there are potential benefits in the housing or water system sector, for implementing this kind of practice. However, in developed countries impact investment has a different scope. In order to have some context, we are going to describe how this financial practice was introduced in these countries.

In June 2013, as part of the UK's presidency of the G8, an independent Social Impact Investment Taskforce was established, with the objective of catalysing a global market in impact investment that improves society [61]. In order to drive its implementation, a National Advisory Board (NAB) was created in each country: Australia, Canada, France, Germany, Italy, Japan, UK, USA. Each NAB is responsible of reporting to the Taskforce on what is required in its country to bring impact investment to take-off. Thus, different recommendations are resulted and addressed to a wide range of actors that can help on the growth of impact investments, such as: governments, private investors, business and social organisations. The main proposals are addressed to government, which in every country plays three different enabling roles [61]:

- As a *market builder*, by upgrading its ecosystem to better support impact investment. It increases the resources and support for impact-driven organisations, while strengthening their operations and growth. Last, develops an impact culture with different intermediaries, and provides advice services to the impact sector.

- As a *purchaser of social outcomes*, that can drive pay-for-success (to pay when a social outcome has been achieved), by increasing the flow of investment from common investors to impact-driven organisations. Also, it provides matching finance where impact investment is emerging, by capitalising impact investment funds.

- As a *market steward*, to remove legal barriers to impact investing and ensure that positive outcomes are sustained overtime. This is done by integrating into exiting regulatory frameworks covering banks and investment funds, and reducing the restrictions on investors engaging in impact investment.

Developed countries do not have the main disadvantage regarding the lack of capital, that is an impediment in the non-profit sector of developing countries. So, in order to carry out this policy framework, the different NAB proposed the use of Social Impact Bonds (SIB). The main idea beneath it is that in order to develop the social outcome of impact investments, governments agree to buy in advance specific social outcomes delivered by impact-driven organisations [61]. The procedure on how SIB work is the following. A government would set timelines and payment levels, and would only pay for verified positive outcomes (pay-for-success). This capital goes to an intermediary that would put together the arrangement, and fund the service provider. In this case, the provider are social sectors that would arrive to the beneficiaries and create positive outcomes. The government would receive back from the intermediary net savings and increased tax revenues.

The main reason why SIB is very attracting among developed countries is because governments are the biggest buyer of social services, and so are attempting to deliver as maximum impact as possible from their expenditure [61]. In the US, up to $300 m in consecutive budgets has been proposed as pay-for-success instruments. That is why the different NAB have started programmes in order to facilitate and deliver this social impact. The UK for example, created the Investment Readiness programme, that has helped unlock almost £100 m in investments and contract values which helped over 100 frontline social ventures and over 600 start-up ventures. This fund helps social ventures access impact investments of at least £500,000, or win contracts over £1 m. In Japan, over two years more than 800 start-up social enterprises were supported with a grant for social innovation of €86 m [61].

Even though impact investment has shown to be well established in developed countries, both in the policy framework (with the different roles of the government) and the financial aspect (with the implementation of SIB), it has a major downside. As we can see from the examples provided above, the budget proposed for this kind of programmes is not enough to fund infrastructure projects. So, it has a focus more towards social sector (such as unemployment) or the entrepreneurship sector (providing early stage capital).

6. RESULTS AND CONCLUSIONS

6.1. Introduction

Throughout the different chapters of this research, both general and more specific conclusions have been reached regarding the financing of infrastructure projects. In this last chapter, the final outcomes of this study are described.

The first section includes the results from chapters 4 and 5. So, based on the two environments proposed, the achievement on the implementation level of the different financing models is resumed.

For the last and second section of this chapter, a more general overview of the whole study outcomes is presented. Also, the answers to the research questions proposed as objectives of the study are discussed.

6.2.Results

The results are presented following the two environments (developing and developed countries) presented in this whole study. Chapter 4 described the five financing models that have been considered: *microfinancing, impact investment, land leasing, project finance and infrastructure project bonds*. The main features and differences among them were highlighted. However, the main interest has been in the implementation of these five practices (chapter 5), in the two environments considered. The results and implications are presented hereafter.

Starting with the developing countries, three models have been implemented in this environment.

The first one is *microfinance*, which is the most representative and suited practice for this type of countries. Even though it has been present for quite a long time (since its first implementation in the 80s), it was not after the global crisis that has acquired more presence. We have seen how the main driver of this financing model are the microfinance institutions (MIFs). These are responsible for the establishment of a policy framework that helps establishing microfinance services on a long term sustainable basis for developing countries. Furthermore, we have probed how the more presence of MIFs in a country, the higher the portfolio size is in the region. However, even though MIFs have proved of being able to active the economy, it is only at a local level. So, MIFs can create positive social outcomes, but does not have the budget capacity to invest in infrastructure projects.

Next, the *impact investment* model is the one that has a double focus, looking to achieve positive social and/or environmental impact in addition to financial return. We can consider it as an extension or a step further from microfinance. Instead of just providing small loans and financial services, this practice focuses its investment towards companies and funds. Also, while the amount of investment is greater in impact investment, the risk associated to this type of investment is lower considering the financial sustainability of the enterprise where the investment is made. So, larger companies and funds use through impact investment, micro finance practices in developing countries looking to provide a positive social and/or environmental impact.

Last, *land leasing* model has a different scope than the two previous practices. It refers to an asset-based financing type, where urban infrastructures are financed directly from the leasing of the land assets. From the three different models considered in developing countries, land leasing is the one that generates greater revenues for financing infrastructures. However, its implementation is focused on a more particular number of countries. These countries have to be undergoing an important urbanization growth, and so land leasing would accelerate the infrastructure investment. Although its great performance, land leasing has the downside that cannot be considered a fixed financing practice for a country, as the supply of land available will run out at some point plus the different risks allocated to the continuous use of this practice.

Now moving to the other type of environment, we have considered also three types of financing models for developed countries.

Starting with *project finance,* it is presented as one of the main solutions in order to fill in the infrastructure gap present in the sector since the global crisis. This financing model operates though a project company (SPV), and so it has a more complex structure than a common corporate finance model. Yet, we have probed how countries that are implementing programmes with this kind of practice, receive loans with lower costs and more flexibility

returns. Also, these programmes help speed up the project delivery, and actually this more complex structure is able to finish the construction earlier than with common practices. In order to add a sustainable focus in project finance, practices such as green banking are gaining more importance. The banking industry (responsible for conceding the loans), through these practices is able to promote the achievement of sustainable targets, with the external impact that each project a bank finance can produce.

The second financing model implemented in developed countries is *infrastructure project bond.* After the global crisis and with investors looking for more real assets, infrastructures emerged as an alternative asset class to the known project finance model. So, the bond market is offered as an alternative to loans, so as to finance infrastructure with longer terms and lower risk returns. Different programmes have started using infrastructure bonds which proved to facilitate the development of the capital market, and at the same time have secured this financing model as a viable option for countries to finance infrastructures. However, it lacks the capacity for sustainability or an environmental impact. Even though the externalities of developing infrastructures tend to benefit society, infrastructure project bond does not have an established way to act for this social and sustainable practices.

As it happened with developing countries, *impact investment* is also presented as a financing model in this type of environment. Even though the concept has also the impact-driven meaning in both social/environmental and economic return, the focus in developed countries is different. This difference is mainly based on the not-lacking capital availability in this environment, so the social outcome of the investments is managed through SIB. Governments use SIB to acquire social services, and only pay back if the investment made is verifies positive social/environmental outcomes. Many countries have started funding NAB to manage this kind of services, and so it is an established practice. The major disadvantage is that the quantity of budget that a SIB can manage is not enough for an infrastructure project. So, in this case we have a solid practice regarding the social/environmental outcomes, but that alone is not able to solve the gap in infrastructure in developed countries.

So as to summarize the results from the financing models, the following table (*table 6.1*) shows the main characteristics from each of the five models. We can see how the graph classifies the results for each model, based in four different aspects:

- *Environment*, it divides depending on the type of country that the model can be applied to (developing, developed or both).
- *Institution or Market,* makes reference to the area or organisation through which the financing model operates.
- *Sustainability,* based on the ability of each financing model to create positive externalities either social, environmental or both.

- *Infrastructure financeable,* sorts each model entirely on the capacity of financing infrastructure projects.

Financing model	Environment	Institution/ Market	Sustainability	Infrast. financeable
Microfinance	Developing	MIFs	Social	No
Impact investment	Both	NABs	Both	No
Land leasing	Developing	Land	No	Yes
Project finance	Developed	SPVs	Both	Yes
Infrastructure bond	Developed	Bond	No	Yes

Table 6.1 - *Resume of characteristics of the financing models*

6.3.Conclusions

This study has been driven by the following general research question: *what is the current state of knowledge on the implication of financing models on infrastructure projects?* In order to break it down, three approaches have been made to the question:

1) *What are the similarities and differences between the various financing models*?

Even though the five financing models considered have different characteristics, depending on the point of view, some common aspects can be highlighted among them.

First, if we consider the similarities based in the concept of the financing model we have the next groups. Impact investment can be considered as an extension of microfinance, because using microfinance practices not only looks for financial but also for social/environmental returns, while the budget size is greater. Also, both project finance and infrastructure project bonds, come from the same idea of considering private instead of public investors. But while project finance uses loans as investment, infrastructure bond make use of the bond market. In this categorization, land leasing can be considered as a totally independent concept of financing.

Last, if we analysed it through the procedure of implementation, we can state the following similarities. Regarding those models that make use of an institution or vehicle for financing or investing, we have that microfinance uses MIFs, while project finance operates through SPVs, and impact investment is run by NABs. Other financing models use alternative asset classes to finance infrastructures. That is the case of land leasing, using land as its asset class; or infrastructure project bonds, using the infrastructure itself as its asset class.

2) *To which degree are each financing models able to be applied in the civil infrastructure sector?*

In this study, to answer the level of implementation of each financing model we have based it on the type of environment.

For developing countries, although three different models have been considered in this environment, just two can be applied to infrastructure projects. Land leasing can be considered as the one that greater revenue is able to generate, so as to finance infrastructure. It is only applicable in countries that are undertaking an urbanization process, and it can be applied to a maximum of approximately 15 years. Then, microfinance as the main developer of economy in this environment, cannot directly finance infrastructure projects due the limited budget that MIFs manage. That is why, microfinance practices through an impact investment policy, could be able to reach greater funds and be applied to infrastructure projects like housing or water systems.

For developed countries, also two out of three financing models considered can be applied in the civil engineering sector. The project finance model has proved to grant loans at lower cost and higher flexibility payments against corporate finance, while being able to fund and develop infrastructure projects. Also, infrastructure project bond, as an alternative to project finance and typical loans, has proved through bond market to finance infrastructure projects with longer terms and lower risk returns. Last, impact investment can be established in developed countries, but the range of budget that it manages cannot be applied for infrastructure projects, yet it has proven to be a solid social-project enabler.

3) *Which are the main conclusions disclosed from the cases that the different models have been applied to, and what is the potential relation with sustainable development?*

- Microfinance is the most adequate financing model in order to activate and develop the economy in this environment. Even though it is not able to directly finance infrastructure projects, it works as a basis for further implementation of more elaborated models, such as impact investment or land leasing. Notice that in order to apply these latest, a minimum previous economic wealth is needed, and so microfinance can provide it. Also, it is a good social developer model to reactivate economy in bare countries.

- Impact investment improves microfinance practices through NAB and involving funds or large companies is able to finance infrastructure, with lower risks. On top of that, the impact-driven strategy in both economic and social/environmental aspects, guarantees a sustainable development of the projects financed.

- Land leasing generates the greatest revenue in this environment, but only works as a temporal practice to reach a developed state in the country. It is able to directly finance infrastructure projects, and is used when a country is already undergoing a process of urbanization and/or decentralization. Thus, it does not work in countries with a bare

economy situation or in countries that it has been applied for more than 15 years. In order to be related to sustainable practices, the over-exploitation of this model has to be avoided.

- Project finance is the main alternative to the public sector and corporate finance model investments on infrastructure projects. It can be related to sustainable practices through green banking. Banks conceding the loans to projects are able to select and promote those that would achieve positive externalities.

- Infrastructure project bond is also able to finance projects in the civil engineering sector. As an alternative to bank loans and considering infrastructure as an asset class it has proven to be a solid financing model. However, it lacks the sustainable practices in its procedure. Thus, a complimentary sustainable policy such as the one used in impact investment would complete infrastructure project bond as a proper financing model in the sector.

- Impact investment in this environment is not able to finance infrastructure projects. Yet, the sustainable practices are well established in this model. The procedure used by this model, SIB, manage budgets which are not enough for the civil engineering sector but indeed for social projects. So, in order to balance the economic aspects of this model, other procedures need to be added, such as adapt infrastructure project bonds to this impact investment policy.

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